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**GENDA FOR THE MEETING OF THE ADVISORY BOARD OF THE  
IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH HELD  
AT DELHI ON THE 18TH TO 23RD FEBRUARY 1935.**

1. Decisions of the Governing Body on the recommendations of the Advisory Board made at the latter's meetings in February and September 1934.
2. Appointment of Committees.
3. Report of the Coconut Committee appointed to consider the Report on Coconut Enquiry in India by Dr. J. S. Patel.
4. Recommendations of the Locust Committee at its sixth meeting held in January 1935. Proposals for continuance and future programme of work.
5. Annual report on the working of the rice research scheme in Bengal for the year 1933-34.
6. Annual report on the working of the rice research scheme in Burma for the year 1933-34.
7. Annual reports on the working of the rice research schemes in Madras and United Provinces for the year 1933-34 and in the Central Provinces for the period September 1932—March 1934 (reports already circulated to the Advisory Board with this Department Memorandum No. F.-229/34-A., dated 8th November 1934).
8. Cancelled.
9. Annual report on the working of the Agricultural Meteorology Branch, Poona, for the second year ending 21st August 1934.
10. Cancelled.
11. Report on (i) the Laboratory for collecting, breeding and despatching beneficial parasites at Farnham House for the year ending 31st March 1934 and (ii) the investigations into the control of insects and moulds injurious to stored products at Slough for the year 30th September 1933 to 1st October 1934.
12. Report on the deputation abroad of Dr. B. N. Uppal, Plant Pathologist to the Government of Bombay, for the study of virus diseases of plants. (ii) Revival of Dr. Uppal's scheme of investigations into the virus diseases of plants originally sanctioned by the Council, with certain modifications introduced by Dr. Uppal as a result of his deputation abroad.
13. Application from the Government of Bombay for a grant of Rs. 29,070 spread over three years for a scheme of research in Apiculture by Mr. C. J. George, Professor of Botany, Wilson College, Bombay.
14. Application from the Government of Baroda for a grant of Rs. 16,900 spread over five years for a scheme of research on bee-keeping for Gujerat.

15. Application from the Government of Bombay for a grant of Rs. 1,22,310 spread over a period of ten years for research in goat breeding in the Bombay Presidency.
16. Application from the Government of Bombay for a scheme of research in Poultry Husbandry to be conducted in the Bombay Presidency at a cost not exceeding Rs. 61,053 (Rs. 22,023 non-recurring and Rs. 39,030 recurring) spread over a period of 5 years.
17. Scheme for research in economic ornithology at a cost of Rs. 41,075 spread over a period of five years submitted by Mr. Salim A. Ali submitted through the Government of Bombay.
18. Reference from Public Health Commissioner to the Government of India regarding a proposal from Major-General Sir R. McCarrison, Kt., C.I.E., K.H.P., I.M.S., Director, Nutrition Research, Indian Research Fund Association for a survey of food-material and their food values throughout India.
19. Application from the Government of Bombay for a grant of Rs. 85,542 spread over five years for a scheme of research in groundnut in the Bombay Presidency.
20. Application from the Government of Travancore for a grant of Rs. 92,880 spread over five years for a scheme for the investigation of the 'root disease' of the coconut palm in South India.
21. Application from the Government of the United Provinces for a grant of Rs. 10,000 spread over three years for undertaking cotton seed crushing and supply of decorticated cake for educative propaganda.
22. Application from the Government of Bombay for a grant of Rs. 78,650 spread over a period of five years for a scheme for the improvement of papaya breeding and cultural practices.
23. Application from the Government of Bombay for a grant of Rs. 30,060 spread over two years for a scheme of research on agricultural economics by the Director, Gokhale Institute of Politics and Economics.
24. Application from the Government of the Central Provinces for a grant of Rs. 35,500 spread over a period of five years for a scheme of research work on pan cultivation.
- 25(a) Application from the Government of Bombay for a grant of Rs. 49,360 spread over five years for a scheme for investigation into the attack on jowar by the parasite 'striga'.
- (b) Application from the Government of Bombay for a grant of Rs. 37,510 spread over five years for a scheme for the investigation of the attack on tobacco by the Phanerogamic Parasite 'Orobanches'.
26. Cancelled.
27. Scheme of research on sunn hemp manufactures in Bombay.

28. Application from the Government of Baroda for a grant of Rs. 12,000 spread over a period of three years for a scheme for research on (i) the preservation of mahura flowers, and (ii) the manurial value of spent flowers.
29. Agricultural marketing.
30. Central Tobacco Research Station at Guntur in the Madras Presidency.
31. Application from the Andhra University for a grant of Rs. 1,000 for a scheme to find out the best method of extracting nicotine commercially from tobacco waste and to design an apparatus for the same.
32. Application from the Director General of Observatories, Poona, for a grant of Rs. 1,39,000 spread over five years for a revision and extension of the present scheme of agricultural meteorology already sanctioned by the Imperial Council of Agricultural Research.
33. Proposal for an All-India Fertilisers Act (Committee only).
34. Report of the Tractor Committee of the Advisory Board on the report of the Tractor Ploughing work carried out by the Burma Shell Oil Storage and Distributing Co. of India, Ltd., Bombay during the 1933-34 season.
35. Appeal for an endowment Fund for a Central Library for animal diseases from the Royal College of Veterinary Surgeons.
36. Enquiry from the Director of Economic Entomology, of the Council for Scientific and Industrial Research for the appointment of an entomologist in India at their cost to study the natural control of blowflies and of the buffalo-fly.
37. Application by the University of Edinburgh for a grant towards the cost of courses of instruction for the Diploma in Tropical Veterinary Medicine.
38. Application from Mr. J. J. De Valois of the Agricultural Institute, Katpadi, for a scheme of research on goat breeding at a cost not exceeding Rs. 84,172 (Rs. 5,480 non-recurring and Rs. 78,692 recurring) spread over a period of ten years.
39. Proposal to appoint provincial dairy committees.
40. Application from the United Provinces Poultry Association for a grant for research into the preservation and handling of eggs and poultry prior to their disposal in the market at a cost not exceeding Rs. 32,570 (Rs. 5,784 non-recurring and Rs. 26,786 recurring) spread over a period of three years.
41. Cancelled.
42. Proposal for the continuance of statistical section for five years from the 1st December 1935 (with special reference to the Advisory Board's previous recommendations regarding the planning and interpretation of field experiments).

43. Report of the Potato Committee on technical details of the scheme for potato research in Northern India sanctioned by the Governing Body.
  44. Reconstitution of those sub-Committees of the Imperial Council of Agricultural Research, appointed under Rule 30, which have been in existence for two years or more.
  45. Proposals for the initiation of future research into the insect pests of Sugarcane.
  46. Appointment of Provincial Committees for the definition of Breed characteristics.
  47. Application from the Government of the United Provinces for a grant of Rs. 1,96,720 spread over 5 years for research into the feeding of cattle at the Departmental farms.
  48. Proposal for the appointment of a Disease Investigation Officer for Sind and Ajmer Merwara.
  49. Proposal for the establishment of a Central Animal Nutrition Institute.
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PROCEEDINGS OF THE MEETING OF THE ADVISORY BOARD OF  
THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH  
HELD AT DELHI ON MONDAY, THE 18TH FEBRUARY 1935.

The following were present:—

1. Diwan Bahadur Sir T. VIJAYARAGHAVACHARYA, K.B.E., *Chairman*.
2. Mr. R. G. ALLAN.
3. Dr. B. K. BADAMI.
4. Mr. B. C. BURT.
5. Mr. P. H. CARPENTER.
6. Mr. J. N. CHAKRABARTY.
7. Mr. T. J. EGAN.
8. Dr. T. EKAMBARAM.
9. Mr. E. S. FARBROTHER.
10. Mr. J. W. GRANT.
11. Dr. L. K. HYDER.
12. Mr. NIZAMUDDIN HYDER.
13. Dr. B. N. IYENGAR.
14. Mr. P. J. KERR.
15. Mr. K. K. WARRIAR.
16. Dr. V. N. LIKHITE.
17. Mr. A. M. LIVINGSTONE.
18. Mr. K. McLEAN.
19. Mr. A. M. MUSTAFA.
20. Dr. NAZIR AHMAD.
21. Dr. S. S. NEHRU.
22. Colonel A. OLVER.
23. Mr. B. S. PATEL.
24. Mr. K. P. PILLAI.
25. Mr. T. F. QUIRKE.
26. Diwan Bahadur T. RAGHAVIAH.
27. Mr. S. V. RAMAMURTY.
28. Mr. J. H. RITCHIE.
29. Mr. G. P. SEN.
30. Mr. D. R. SETHI.
31. Dr. F. J. F. SHAW.
32. Mr. H. R. STEWART.
33. Mr. A. SUBRAMANYAN.
34. Rao Bahadur C. TADULINGAM.
35. Mr. G. T. TAIT.
36. Mr. C. N. VAKIL.



37. Mr. F. WARE.

Rai Bahadur Malik CHARAN DAS, *Secretary.*

The following attended as visitors :—

1. Professor S. P. AGHARKAR.
2. Mr. M. D. AVASARE.
3. Mr. E. M. BEE.
4. Mr. E. J. BRUEN.
5. Mr. L. D. GALLOWAY.
6. Mr. HUKAMAT KHAN.
7. Dr. K. C. MEHTA.
8. Mr. T. J. MIRCHANDANI.
9. Professor P. K. PARIJA.
10. Mr. K. RAMIAH.
11. Mr. C. B. SAMUEL.
12. Mr. A. M. THOMSON.
13. Mr. M. VAIDYANATHAN.
14. Dr. F. J. WARTH.

2. The meeting commenced at 11 A.M. and adjourned at 1-10 P.M.

3. In welcoming members to the meeting the Chairman particularly referred to the new members, namely, Professor Vakil, representative of the Inter-University Board, Mr. Grant from Burma and Mr. Patel, Acting Director of Agriculture, Bombay, who were attending for the first time.

4. *Decisions of the Governing Body on the recommendations of the Advisory Board made at the latter's meeting in February and September 1934 (Subject No. 1 of the Agenda). (Appendix I).*

In introducing the subject the Chairman enquired whether members had any observations to make and said that the Governing Body had accepted the recommendations of the Advisory Board in the case of all the schemes mentioned in the note. He added that the Governing Body postponed consideration of the application from the Government of Bombay for the grant of Rs. 48,916 spread over a period of two years for a tractor ploughing scheme for the eradication of Hariali in deep black cotton soils, because the Governing Body desired to hear the representative of Bombay who was not present at the meeting.

5. *Appointment of Committees (Subject No. 2 of the Agenda). (Appendix II).*

The proposals regarding the appointment of committees were approved with the following modifications.

*Rice-Sub-Committee.*

It was decided to add Mr. Grant, Rice Research Officer, Burma, and Mr. Ritchie, Director of Agriculture, Central Provinces, to the Committee.

*Plant Diseases Sub-Committee.*

Dr. Likhite, Deputy Director of Agriculture, Baroda, and the Mycologists of Bombay and Mysore (if present) were added to the Committee.

*Agricultural Meteorology Sub-Committee.*

Dr. Nazir Ahmad and Professor Agharkar were added to the Committee.

*All-India Fertilizers Act Sub-Committee.*

Mr. Grant (Burma), the Director of Agriculture, Mysore, and Mr Mayadas were added.

*Standing Cattle Breeding Committee.*

Messrs. Ramamurty (Madras), Egan (United Provinces) and Ware (Muktesar) and Dr. Badami (Hyderabad) were added.

*Standing Animal Nutrition Committee.*

Mr. Ware (Muktesar) was added.

*Bee Committee.*

Messrs. Bruen, Ramamurty, Director of Agriculture, Assam, Dr. Likhite, Mr. Nizamuddin Hyder, Mr. Ware and Director of Agriculture, Bombay, were added.

The dates for the meetings of the various committees proposed in the note (Appendix II) circulated on the subject were also approved with the slight modification that the Rice Sub-Committee should meet at 11 o'clock on Tuesday, the 19th February 1935.

6. *Report of the Coconut Committee appointed to consider the Report on Coconut Enquiry in India by Dr. J. S. Patel (Subject No. 3 of the Agenda).* (Appendix III).

Mr. Burt introduced the Report and explained the various recommendations made by the Coconut Committee of the Council and moved that the Report be adopted. The motion which was seconded by Mr. Ramamurty was carried unanimously.

7. *Report on (i) the Laboratory for collecting, breeding and despatching beneficial parasites at Farnham House for the year ending 31st March 1934 and (ii) the investigations into the control of insects and moulds injurious to stored products at Slough for the year 30th September, 1933 to 1st October 1934 (Subject No. 11 of the Agenda).* (Appendix IV).

Mr. Burt introduced the subject and said that three Entomologists from India had recently received special training at the Laboratory at Farnham House. In his opinion the institutions were very useful to India and the assistance given by the Imperial Council of Agricultural Research was quite justified. Mr. Stewart said that Farnham House had despatched parasites to various countries but not to India and enquired whether it would be possible to get parasites for this country also. He referred especially to parasites of *Woolly Aphis* on apples in which the Punjab was specially interested. Mr. Burt replied that if the Director of Agriculture, Punjab, would put up proposals and send them to the Imperial Council of Agricultural Research a reference would be made. He added that any large scale supply of parasites would, probably, have to be paid for because the financial assistance given to the Farnham House Laboratory by the various Empire countries was only for maintenance purposes. After further discussion Mr. Burt moved that the Advisory Board records the opinion

that the work done at Farnham House and at Slough is useful to India and that the support of the Council to the two institutions should be continued. The Board agreed.

8. *Report on the deputation abroad of Dr. B. N. Uppal, Plant Pathologist to the Government of Bombay, for the study of virus diseases of plants (ii) Revival of Dr. Uppal's scheme of investigations into the virus diseases of plants originally sanctioned by the Council, with certain modifications introduced by Dr. Uppal as a result of his deputation abroad (Subject No. 12 of the Agenda). (Appendix V).*

It was decided to refer the scheme to the Plant Diseases Sub-Committee whose report (Appendix XXVII) would be considered by the Board during the current session.

9. *Scheme for research in economic ornithology at a cost of Rs. 41,075 spread over a period of five years submitted by Mr. Salim A. Ali submitted through the Government of Bombay (Subject No. 17 of the Agenda). (Appendix VI).*

As Mr. Salim A. Ali, who is the author of this scheme and who had been invited to explain the scheme, was not present the consideration of the scheme was postponed to a later day during the current session.

10. *Application from the Government of Bombay for a grant of Rs. 85,542 spread over five years for a scheme of research in groundnut in the Bombay Presidency (Subject No. 19 of the Agenda). (Appendix VII).*

Mr. Patel introduced the scheme and said that as proposed in the note circulated on the subject it might be referred to the Indian Oil Crushing Industry Committee of the Council for examination in the first instance. Mr. Stewart said that though the scheme was likely to be of considerable importance to Bombay yet that Government was not prepared to undertake any financial liability with respect to it and it seemed that the Council was expected to provide everything, including buildings. This was a scheme which obviously could not be completed in five years and he enquired what would happen to it at the end of that period if it were now approved. He was of the opinion that it was not essential to refer the scheme to the Indian Oil Crushing Industry Committee and that it should be rejected outright, since the Local Government is not prepared to contribute anything towards its cost. Mr. Carpenter criticised the scheme firstly because the Bombay Government were not prepared to undertake any liability for it and secondly the scheme was not likely to finish in 5 years and had been prepared on the basis of a further extension. He expressed the view that to extend this scheme after 5 years would mean blocking some other new scheme which might be more important but which it would not be possible to start as schemes already started could not be left half way. He suggested that the scheme should either be referred back to the Government of Bombay for consideration of these points or should be rejected. Mr. Burt mentioned that a scheme of research in Madras had already been sanctioned by the Governing Body, after being first referred to the Indian Oil Crushing Industry Committee, which after scrutiny cut out a good deal from the original scheme. The Madras scheme and work already in progress at Coimbatore covered a good deal of the proposed programme and he considered that the scheme should be referred to the Oil Crushing Industry Committee; with it should be sent the observations of the Board. Mr. Patel agreed with Mr. Burt

and said that the instructions to the Committee should include the point as to how far the present scheme could be modified so as to fit in with the Madras scheme. This proposal was carried on the understanding that the points raised in the discussion would be considered by the Committee.

11. *Application from the Government of Travancore for a grant of Rs. 92,880 spread over five years for a scheme for the investigation of the 'root disease' of the coconut palm in South India (Subject No. 20 of the Agenda). (Appendix VIII).*

It was decided to refer this scheme to the Plant Diseases Sub-Committee to which the following members were added:—

Director of Agriculture, Travancore.

Director of Agriculture, Madras,

Mr. Carpenter.

12. *Application from the Government of the United Provinces for a grant of Rs. 10,000, spread over three years for undertaking cotton seed crushing and supply of decorticated cake for educative propaganda (Subject No. 21 of the Agenda). (Appendix IX).*

Mr. Alian introduced the scheme and said that it did not involve any large expenditure. All that was required was a guarantee against loss in case the cake was not taken at the estimated price (25 per cent. higher than the seed) by the various Provincial Agricultural Departments. The maximum possible loss came to Rs. 10,000. Mr. Burt explained that the Indian Oil Crushing Industry Committee had taken the initiative in the matter and had asked the Harcourt Butler Technological Institute whether they could supply cake to other provinces. In his opinion they were in a vicious circle inasmuch as there was no demand for decorticated cotton seed cake because regular supplies were not available and supplies were not available because there was no demand. Mr. Patel said that a firm at Navasari, Bombay Presidency, had been producing decorticated cotton seed cake for the last 7 or 8 years and working at a profit. They had been able to sell every pound of cake they produced and he suggested that instead of sanctioning the present scheme enquiries might be made from the firm as to whether they could supply the quantities required. In reply to an enquiry Mr. Patel said that complaints had been received that the use of large quantities of decorticated cotton seed cake as cattle food cause night blindness. Mr. Bruen said that there had been cases of night blindness and these were, in his opinion, due to excessive feeding with this cake. Mr. Ramamurty suggested that it should be ascertained first whether this firm would be able to meet requirements. Dr. Nehru referred to the proceedings of the Voronezh Institute for Animal Breeding in Russia and said that these might throw some light on the subject. He suggested that the Imperial Council of Agricultural Research Secretariat might see whether they could get hold of these proceedings if not he offered to lend his own set thereof for the purpose. Mr. Carpenter was of the view that the point of night blindness raised by some speakers was separate from the object of this scheme. As decorticated cotton seed cake was available at Navasari it would not be right for the Council to sanction the scheme and thus come in direct competition with private enterprise. He saw no reason to support the scheme and suggested its rejection unless it were first ascertained that the firm was unable to supply. Mr. Bruen

agreed with Mr. Carpenter and said that by sanctioning the scheme they would be doing injustice to the Navasari firm. Mr. Stewart suggested that the consideration of the scheme might be held over till the next meeting of the Board and meanwhile enquiries might be made from the firm as to whether they would be able to supply the article in sufficient quantities. Another point that might be considered in this connection was that of transport charges from Navasari to the various provinces requiring it, namely, United Provinces, Bihar, Central Provinces, Bengal and Punjab. In the end Mr. Patel was asked to make enquiries telegraphically from the firm as suggested above and submit the result thereof to the Board if possible at a later date during its present session when the matter would be pursued further. Mr. Tait, Central Publicity Officer, Indian Railways, also promised to furnish information in regard to the railway transport charges from Navasari to Cawnpore (United Provinces), Lyallpur (Punjab), Madras, Calcutta (Bengal), Patna (Bihar and Orissa) and also from Cawnpore to the same centres.

13. *Application from the Government of Bombay for a grant of Rs. 30,060 spread over two years for a scheme of research, on agricultural economics by the Director, Gokhale Institute of Politics and Economics. (Subject No. 23 of the Agenda). (Appendix X).*

Mr. Patel introduced the scheme. Mr. Sethi raised the point whether the scheme was of all-India importance, to which Mr. Patel replied that the results of the working of the scheme would be applicable to other places. Mr. Livingstone said that the scheme consisted of two parts, viz., (i) marketing research and (ii) farm management research. In regard to the former he said that this would be covered by the marketing scheme recently sanctioned by the Government. He was therefore unable to support this part. As regards the farm management research, he thought that similar work was being done in connection with the economic enquiry into the cost of production of crops and that, in his opinion, this part of the proposed scheme should be postponed. Mr. Ramamurty suggested that instead of sanctioning a separate scheme for farm management research it would be sufficient if by spending a small amount the work could be done under the joint enquiry scheme already in progress. Mr. Patel admitted that if the work was done under the Joint Enquiry scheme the object underlying the present scheme would be achieved but some more staff would be needed. Mr. Ramamurty expressed the opinion that if any province could, without extra expense, find its way to do this work along with the existing enquiry scheme it might be permitted to do so. Mr. Burt agreed with Mr. Ramamurty except in regard to details of finance and said that the matter might be placed before the next meeting of the Advisory Board and meanwhile provinces be consulted and asked to furnish the Council with their suggestions. Mr. Carpenter supported Mr. Burt's suggestion and said that the scheme should be drawn up in a most careful manner and before it is resubmitted to the Board it should be considered by a Sub-Committee with definite instructions that care should be taken to co-ordinate the work. This suggestion was approved on the understanding that the Gokhale Institute of Politics and Economics which had sent up the present scheme would not be excluded by the Sub-Committee. It was also decided that the personnel of the Sub-Committee should as usual be settled by the Vice-Chairman of the Council.

14. *Application from the Government of Baroda for a grant of Rs. 12,000 spread over a period of three years for a scheme for research on (i) the preservation of mahura flowers, and (ii) the manurial value of spent flowers. (Subject No. 28 of the Agenda). (Appendix XI).*

The scheme was introduced by Dr. Likhite and was further explained by Mr. Avasare, the author of the scheme. Mr. Burt said that as far as he could see the investigations proposed were for purposes of manufacture etc. and were not likely to benefit agriculture. He therefore thought it would be difficult for the Council to finance the scheme. Mr. Sethi said that no investigation was necessary in this case. After Dr. Likhite had replied the scheme was rejected by 15 votes against 2.

15. *Agricultural Marketing (Subject No. 29 of the Agenda). (Appendix XII).*

Mr. Livingstone explained what they had been doing in connection with the agricultural marketing scheme. This was noted.

16. *Application from the Andhra University for a grant of Rs. 1,000 for a scheme to find out the best method of extracting nicotine commercially from tobacco waste and to design an apparatus for the same. (Subject No. 31 of the Agenda). (Appendix XIII).*

Mr. Ramamurty said that this scheme was considered by the Advisory Board at its meeting held in September 1934 when it was decided that the Industries Department, Bombay, should be requested to supply any information available. This information had now been obtained from the Director of Industries, Bombay, *vide* his letter dated the 13th October 1934. (Annexure II to Appendix XIII). He suggested that before the scheme was further considered by the Advisory Board the letter from the Director of Industries, Bombay, should be referred to the Andhra University for any further remarks which they wished to make. This was agreed to.

17. The meeting then adjourned till 11 o'clock on Wednesday, the 20th February 1935, to allow Sub-Committees appointed by the Board to meet in the interval and also the Annual General Meeting of the whole Council to be held at 12-30 P.M. on Tuesday, the 19th February 1935.

CHARAN DAS,

*Secretary.*

DELHI;

*The 18th February, 1935.*

PROCEEDINGS OF THE MEETING OF THE ADVISORY BOARD OF  
THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH  
HELD AT DELHI ON WEDNESDAY, THE 20TH FEBRUARY  
1935.

The following were present:—

1. Diwan Bahadur Sir T. VIJAYARAGHAVACHARYA, K.B.E., *Chairman.*
2. Mr. R. G. ALLAN.
3. Dr. B. K. BADAMI.
4. Rao Bahadur BHIMBHAI R. Naik.
5. Mr. B. C. BURT.
6. Mr. P. H. CARPENTER.
7. Mr. J. N. CHAKRABARTY.
8. Mr. G. K. DEVADHAR.
9. Dr. T. EKAMBARAM.
10. Mr. E. S. FARBROTHER.
11. Mr. J. W. GRANT.
12. Dr. L. K. HYDER.
13. Mr. NIZAMUDDIN HYDER.
14. Dr. B. N. IYENGAR.
15. Mr. P. J. KERR.
16. Dr. V. N. LIKHITE.
17. Mr. A. M. LIVINGSTONE.
18. Mr. K. McLEAN.
19. Mr. A. M. MUSTAFA.
20. Dr. NAZIR AHMAD.
21. Dr. S. S. NEHRU.
22. Colonel A. OLVER.
23. Mr. B. S. PATEL.
24. Mr. K. P. PILLAI.
25. Mr. T. F. QUIRKE.
26. Diwan Bahadur T. RAGHAVIAH.
27. Mr. S. V. RAMAMURTY.
28. Major P. B. RILEY.
29. Mr. J. H. RITCHIE.
30. Mr. G. P. SEN.
31. Mr. D. R. SETHI.
32. Dr. F. J. F. SHAW.
33. Mr. H. R. STEWART.
34. Mr. A. SUBRAMANYAN.
35. Rao Bahadur C. TADULINGAM.
36. Mr. C. N. Vakil.

37. Mr. F. WARE.  
 38. Mr. K. K. WARRIAR.  
 Rai Bahadur Malik CHARAN DAS, *Secretary*.

The following attended as visitors :—

1. Professor S. P. AGHARKAR.
2. Rao Bahadur B. VISWANATH.
3. Mr. E. M. BEE.
4. Mr. E. J. BRUEN.
5. Mr. L. D. GALLOWAY.
6. Mr. HUKAMAT KHAN.
7. Dr. K. C. MEHTA.
8. Mr. T. J. MIRCHANDANI.
9. Dr. B. P. PAL.
10. Professor P. K. PARLIA.
11. Mr. C. H. PARR.
12. Dr. L. A. RAMDAS.
13. Mr. K. RAMIAH.
14. Mr. SALIM A. ALI.
15. Mr. C. B. SAMUEL.
16. Mr. K. C. SEN.
17. Mr. A. M. THOMSON.
18. Mr. M. VAIDYANATHAN.

2. The meeting commenced at 11 A.M. and adjourned at 1 P.M.

3. *Scheme for research in economic ornithology at a cost of Rs. 41,075 spread over a period of five years submitted by Mr. Salim A. Ali through the Government of Bombay (Subject No. 17 of the Agenda). (Appendix VI).*

Mr. Patel introduced the scheme and said that Mr. Salim Ali, the author of the scheme, had great experience of the kind of work proposed. He commended the scheme for sanction. Mr. Livingstone referred to the fact that the work was proposed to be done at Poona and enquired whether it would not be more appropriate to have this work done in North India in reply to which Mr. Salim Ali said that birds were more or less common to the whole of India but differed somewhat in hills. Mr. Ware enquired as to how long the scheme was likely to go on. As far as he could see the work was not likely to finish in five years' time and the scheme if now approved would have to be extended further. Mr. Salim Ali said that his idea in putting up the scheme was to demonstrate during the five years period the importance and utility of the work. This would be achieved during this period and if it was found successful then it would be for the Provincial Governments and States concerned to take it up. Mr. Stewart pointed out that no attempt had been made by the author to ascertain what had already been done on this subject. The Government Entomologist Punjab had had an assistant on this problem for some ten years. He did not think that during five years very great progress was likely to be



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32. Dr. F. J. F. SHAW.
33. Mr. H. R. STEWART.
34. Mr. A. SUBRAMANYAN.
35. Rao Bahadur C. TADULINGAM.
36. Mr. C. N. Vakil.

relating to land, provision of quarters, etc., and the matter would then be placed before the Governing Body.

5. *Report of the Tractor Committee of the Advisory Board on the report of the Tractor Ploughing work carried out by the Burma Shell Oil Storage and Distributing Company of India, Ltd., Bombay during the 1933-34 season (Subject No. 34 of the Agenda). (Appendix XV).*

Mr. Burt introduced the report of the Tractor Committee on the tractor ploughing work carried out by the Burma Shell Oil Storage and Distributing Company of India, Ltd., Bombay, during the 1933-34 season and moved the adoption of the report and that the Board endorses the Committee's appreciation of the work done by the Company. The motion was carried.

6. *Appeal for an endowment Fund for a Central Library for animal diseases from the Royal College of Veterinary Surgeons (Subject No. 35 of the Agenda). (Appendix XVI).*

Colonel Olver introduced the subject. The Chairman referred to the letter from the Secretary, Imperial Agricultural Bureaux, London, dated the 1st February 1935 (Annexure III) in which he stated that he saw no general reasons nor any particular ones connected with the work of the Bureaux system which would justify a recommendation by the Executive Council of the Bureaux that a grant should be made from the State Funds of Overseas Governments to the library for animal diseases established by the Royal College of Veterinary Surgeons. Mr. Ware expressed the opinion that the library was doing good work and recommended a grant on the condition that this would not form a precedent for similar grants in future. Mr. Kerr supported Mr. Ware. Rao Bahadur Bhimbbhai R. Naik enquired whether there was a similar library in India to which Mr. Ware replied that no such complete library existed in this country. Rao Bahadur Naik then said why should we not spend money in completing the library at Muktesar rather than give the grant asked for? Colonel Olver explained that the Royal College of Veterinary Surgeons, the controlling body of the Veterinary profession in the United Kingdom, was distinct from the Royal Veterinary College which is a teaching institution. The library of the former was maintained for the general benefit of the profession and was of the greatest use to post graduate Indian students in London. As the Board knew the present standard of veterinary education in India was inferior to that in London. A large number of students from India were studying in the Royal Veterinary College and the College as well as the library for which a grant was now asked were of great value to India. He supported the suggestion that a grant be made. Professor Agharkar asked as to when we were likely to have the standard of veterinary education raised in India. Colonel Olver replied that the Council had made recommendations after a thorough examination of the question and the delay was now due to financial considerations and the fact that it was almost entirely a provincial matter. Dr. Hyder moved that the Advisory Board recommend a grant of £100. Mr. Sethi seconded the motion which was carried.

7. *Enquiry from the Director of Economic Entomology, of the Council for Scientific and Industrial Research for the appointment of an entomologist in India at their cost to study the natural control of blowflies and of the buffalo-fly (Subject No. 36 of the Agenda). (Appendix XVII).*

made. If the Council was disposed to take up this work the right method of doing so was, in his opinion, to invite the co-operation of all Provincial Governments, States, etc. Mr. Patel said that five years was not too small a period to show whether the work was important or not. Dr. Shaw said that as the scheme involved the employment of Mr. Salim Ali there would be a departure from the condition that the technical staff to be employed on the Council's schemes should be recruited through the Public Service Commission. Mr. Burt said that this was a problem in which the co-operation of Provincial Departments, the Zoological Survey and Zoological Departments of Universities would be necessary and the work would not be finished in 5 or even in 10 years. He suggested that the views of Provincial Departments, Universities, etc., should first be invited on the best way of attacking the problem and on receipt of these it should be considered what central help, if any, was necessary. The matter might then be brought before the next meeting of the Advisory Board. This would mean no delay since the Governing Body would meet after the next meeting of the Board. The Chairman explained that the idea was to have a comprehensive scheme to cover the whole of India. In the end, it was decided that information as regards the work already done and in progress should first be invited from Provincial Departments, the Zoological Departments of India and Universities with suggestions. The information received should then be placed before a Committee consisting of representatives of Universities, Provincial Agricultural and Veterinary Departments, and the Zoological Survey, and the Locust Research Entomologist and a representative of the Bombay Natural History Society. The report of the Committee should be placed before the next meeting of the Advisory Board.

4. *Central Tobacco Research Station at Guntur in the Madras Presidency (Subject No. 30 of the Agenda).* (Appendix XIV).

Dr. Shaw introduced the scheme and said that so far as the object of the scheme was concerned it had already been approved by the Advisory Board at its meeting held in September 1934. As desired by the Board a detailed scheme had now been prepared and was for consideration. Mr. Patel enquired whether the portion of the work relating to the leaf curl disease should not be tagged on to Dr. Uppal's virus diseases scheme. Dr. Shaw replied that this disease was very bad in Bihar and he thought therefore that the work should be done at Pusa. Mr. Ramamurty considered that quarters would have to be provided at Guntur; otherwise there would be difficulty in finding accommodation. Mr. Stewart referred to the provision of Rs. 10,000 for 20 acres of land and enquired whether the sub-station was intended to be permanent or temporary. If it was the latter he thought it would be better to rent land rather than purchase it. Dr. Shaw expressed his willingness to rent land if it was possible to do so. Mr. Ramamurty said that his experience was that it would be better to purchase the land outright and then sell it on the expiry of the scheme as this would be a more advantageous course from the point of view of the Council. The Chairman said that if the Board approved of the scheme in general, enquiries might be made as to whether purchase or renting of land would be more advantageous and with that information the matter would be placed before the Governing Body. Dr. Shaw agreed to this. The scheme was then carried on the understanding that the secretariat of the Council would make all necessary enquiries in regard to the points

relating to land, provision of quarters, etc., and the matter would then be placed before the Governing Body.

5. *Report of the Tractor Committee of the Advisory Board on the report of the Tractor Ploughing work carried out by the Burma Shell Oil Storage and Distributing Company of India, Ltd., Bombay during the 1933-34 season (Subject No. 34 of the Agenda). (Appendix XV).*

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6. *Appeal for an endowment Fund for a Central Library for animal diseases from the Royal College of Veterinary Surgeons (Subject No. 35 of the Agenda). (Appendix XVI).*

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7. *Enquiry from the Director of Economic Entomology, of the Council for Scientific and Industrial Research for the appointment of an entomologist in India at their cost to study the natural control of blowflies and of the buffalo-fly (Subject No. 36 of the Agenda). (Appendix XVII).*

Colonel Olver said that this was an unusual application from another country for the appointment of an Entomologist in India at the applicants cost to study the natural control of blow-flies and of the buffalo-fly. The matter had been discussed at the Cattle Breeding Committee which considered that further information from the Council of Scientific and Industrial Research was necessary. Mean-while, the Committee considered that the Board should agree to the proposal generally and authorise the Council's secretariat to obtain the further necessary information promised and on receipt to take requisite action. This was agreed to.

8. *Application by the University of Edinburgh for a grant towards the cost of courses of instruction for the Diploma in Tropical Veterinary Medicine (Subject No. 37 of the Agenda). (Appendix XVIII).*

The scheme was introduced by Colonel Olver. Mr. Carpenter suggested that we might enquire first whether the Dominions were contributing to this institution; if they were, India might also contribute. If on the other hand other Empire countries were not doing so, then, he saw no reason why India alone should contribute. Mr. Burt referred to the High Commissioner's letter of 15th November 1934 which had been circulated to the members and said that a grant of £1,000 per annum for three years was made in 1931 from the Colonial Development Fund, so that the point raised by Mr. Carpenter was met. Special courses of instruction in tropical veterinary science were not of great importance to the Dominions but of special value to India, to tropical Africa and to Colonies like Ceylon and the West Indies. The Chairman referred to the opinion expressed by the High Commissioner that since during the four years 1930-31 to 1933-34 Indian students had been rather more than 25 per cent. of the total number of students there was *prima facie* ground for a grant upto £150 per annum. The High Commissioner had, however, recommended a grant of £100 only in the first instance for the academic year 1935-36 and suggested that the position be reviewed thereafter in the light of what in the meantime had been done by other bodies to institute similar courses. Mr. Burt explained that the general principle had now been accepted that the Empire services rendered by the institutions in the Empire should be on the basis of payment according to the services rendered and in making his recommendation the High Commissioner had followed this principle. The motion that the High Commissioner's recommendation be accepted was carried.

9. *Proposal for the continuance of Statistical Section for five years from the 1st December 1935 (with special reference to the Advisory Board's previous recommendations regarding the planning and interpretation of field experiments). (Subject No. 42 of the Agenda). (Appendix XIX).*

Mr. Burt introduced the subject and said that the main work now being done in the statistical section of the Imperial Council of Agricultural Research was concerned with field experiments and that he believed this work had been found of great value to all agricultural departments in India. Dr. Shaw, in supporting the proposal, said that he was greatly indebted to the statistical section for all the help that he had received from it. He expressed the view that the Section would be required on a permanent basis. The scheme was also supported by Mr. Tadulingam. Mr. Carpenter also spoke appreciatively of the help he had received from the Statistician in solving statistical problems and in supporting the scheme said that, in his opinion, the pay proposed in the scheme for the Statistician was of rather a meagre nature and said specially that an allowance of Rs. 150 on the

time-scale as granted to heads of sections at Pusa should be given to the Statistician also. Messrs. Stewart, Nizamuddin Hyder, and Diwan Bahadur Raghaviah and several others associated themselves with the remarks made by the previous speakers as to good work being done by the Statistician. Colonel Olver said that the Statistical Section was of great use on the Animal Husbandry side also. Mr. Carpenter then moved and Dr. Shaw seconded an amendment that the scale of pay proposed for the Statistician by the Vice-Chairman should be improved by the addition of an allowance of Rs. 150. This was carried. The following proposals were then passed by the Board.

- (1) The scheme should be continued for five years with the ultimate object of making it a permanent section of the Council's activities.
- (2) The pay of the Statistician should be Rs. 650, in the revised Pusa scale, Class I, of Rs. 325—25—600 (E. B.)—25—650—35—1,000/- plus an allowance of Rs. 150 per mensem on the analogy of the allowance admissible to heads of Sections at Pusa.
- (3) The proposals made for the staff of the section, for travelling allowance and provident fund as detailed in the scheme was approved. The whole scheme as modified above was then put to the vote and approved.

10. *Application from the Government of Bombay for a grant of Rs. 29,070 spread over three years for a scheme of research in Apiculture by Mr. C. J. George, Professor of Botany, Wilson College, Bombay, (Subject No. 13 of the Agenda). (Appendix XX).*

*Application from the Government of Baroda for a grant of Rs. 16,900 spread over five years for a scheme of research on bee-keeping for Gujerat (Subject No. 14 of the Agenda). (Appendix XX).*

The Chairman explained that these schemes had been considered (*vide* report at Appendix XX-A), by the Bee Committee appointed by the Board. It was felt that essential facts connected with the subject of Bee keeping were not fully known at present. The Committee had therefore suggested that the consideration of the schemes might be postponed till the next meeting and meanwhile another committee consisting of such people as were in a position to furnish the necessary information be constituted, the exact personnel being left to the Vice-Chairman as usual. The Board agreed.

11. *Application from the Government of Bombay for a grant of Rs. 78,650 spread over a period of five years for a scheme for the improvement of papaya breeding and cultural practices. (Subject No. 22 of the Agenda). (Appendix XXI).*

*Report of the Fruit Research Sub-Committee. (Appendix XXI-A).*

Mr. Burt introduced the report of the Fruit Research Committee and said that it would be observed that a comprehensive scheme of work was not called for at present. The Committee had come to the conclusion that it would be sufficient for the present to undertake the cytological investigation proposed with an Assistant on Rs. 110—8—150 and to give a grant of Rs. 1,500 for special apparatus. The cost of the scheme would then come to about Rs. 5,748 or say Rs. 6,000 round spread over a period

37. Mr. C. N. VAKIL.
38. Mr. F. WARE.
39. Mr. K. K. WARRIAR.

Rai Bahadur Malik Charan Das, *Secretary*.

The following attended as visitors:—

1. Mr. M. AFZAL HUSSAIN.
2. Professor S. P. AGHARKAR.
3. Mr. E. J. BRUEN.
4. Mr. L. D. GALLOWAY.
5. Dr. T. J. MIRCHANDANI.
6. Dr. T. G. SHIRNAME.
7. Professor P. K. PARIJA.
8. Dr. L. A. RAMDAS.
9. Mr. K. RAMIAH.
10. Mr. C. B. SAMUEL.
11. Mr. A. M. THOMSON.
12. Mr. M. VAIDYANATHAN.
13. Rao Bahadur B. VISWANATH.
14. Dr. F. J. WARTH.

2. The meeting commenced at 11 A.M. and adjourned at 1-10 P.M.

3. *Application from the Government of Bombay for a grant of Rs. 78,650 spread over a period five years for a scheme for the improvement of papaya breeding and cultural practices. (Subject No. 22 of the Agenda). (Appendix XXI).*

Further discussion on this subject which had been postponed on the 20th February 1935 was resumed. Dr. Ekambaram said that some work on papaya had been carried out by Professor Ahsan at the Gujerat College, Ahmedabad, and that this work could be carried on more economically in a University Laboratory than in the Department of Agriculture. The only expense that would then be necessary would be a scholarship of Rs. 75 per mensem for an M.Sc., postgraduate student who would work the scheme and Rs. 100 to 150 a year for contingencies. In reply to an enquiry from the Chair, Mr. Patel said that if anybody was willing to do the work at so little expense he had absolutely no objection to the work being given to him. Mr. Patel added that so far as he knew there was no apparatus available for the work at the Andheri College where Professor Ahsan was now working, he was liable to be transferred from place to place so that they could not depend on continuity of work. Dr. Ekambaram said that apart from the Gujerat College work could be done in many Universities. For instance, the work could be done at the Agra College, Mysore University, Madras University, Calcutta University, etc. Mr. Burt said that it was only right to state that this point had definitely been considered by the Fruits Committee which had come to the conclusion that if the work was entrusted to a post-graduate student he would write his thesis, get his M.Sc., degree and then leave the

work just when it became difficult and agriculturally of interest. That was why the Committee proposed to provide the Economic Botanist, Bombay, with a definite assistant. The Committee felt that while they were all anxious to co-operate with Universities in every way they did not consider it desirable to entrust this piece of work to a post-Graduate student. Professor Agharkar said that the students working in Calcutta were always MSc., post-Graduate students. Besides there were two permanent members on the staff of the University who were suitable for this work. Mr. Burt said that the Committee was informed, that Professor Kumar, who was the author of the scheme, was himself a Cytologist. The Poona Agricultural College, where it was proposed to carry out the work, was a constituent College of the Bombay University. Mr. Devadhar said that it seemed to him that the scheme was likely to suffer because of the discussion on the point whether it should be run by the Agricultural Department or by the University. In view of the fact that the Government of Bombay had not offered any contribution the best course would, in his opinion, be to refer the matter again to that Government and ask whether they would make any contribution. Mr. Carpenter pointed out that a good deal of work had been done on this subject but not perhaps received full publicity so far. He suggested remitting the scheme to the Committee again with a request that they might investigate what work had already been done and what had been published. Mr. Burt moved that, with the exception of the following words in the Fruit Research Sub-Committee's report.

"It therefore recommends that a preliminary investigation on the cytology of the Papaya should be carried out with a view to subsequent study of sex inheritance".

the report of the Committee be adopted by the Board and the author may be asked to make a further study of previous literature on the subject. Meanwhile, consideration of the scheme might be postponed till the next meeting of the Board. This proposal was carried.

4. *Recommendations of the Locust Committee at its sixth meeting held in January 1935. Proposals for continuance and future programme of work: (Subject No. 4 of the Agenda). (Appendix XXII).*

Mr. Burt opened the subject and referred to the recommendations of the Locust Committee contained in the note circulated on the subject. These recommendations fell into two parts, *viz.*, one relating to the continuance of the main locust research scheme under the Locust Research Entomologist, Karachi, and the other the work on the study of biology and bionomics of the desert locust conducted at Lyallpur under the supervision of Mr. Afzal Hussain, Entomologist to Government, Punjab. The Board agreed to the continuance for one year with effect from 1st April 1935 of the first part of the scheme, *viz.*, locust research scheme at Karachi.

As regards the second part, the recommendations were contained in clauses (i) (ii), (iii) and (v) of paragraph 3 of the note circulated on the subject. Mr. Burt explained that for this part of the scheme a grant amounting to Rs. 6,000 was given to the Punjab Government last year. The sanctioned period of the scheme was due to expire on the 31st March 1935. He moved for the consideration, in the first instance, of proposals contained in clauses (i), (ii), and (v), the point raised in clause (iii) method of publication being taken up afterwards. Mr. Afzal Hussain explained that originally the whole



scheme of locust research was conducted under his control till the end of the year 1933-34. Owing to certain changes in the administrative staff of the Punjab Agricultural College, Lyallpur, his own services for the whole of the work were no longer available with the result that the work that was being done at Lyallpur was separated from the main scheme and left under his own supervision. He felt that after having worked for so many years the proposal in clause (v) of the note referred to above was not very encouraging inasmuch as if, as proposed by the Committee, a fresh application was submitted to the Council for a grant for continuance of this work after 1935-36 through the Punjab Government and its Research Committee it would have to be regarded as a new scheme and would depend for its initiation on the funds that might be available for all the schemes requiring to be financed. That would in all probability cause a break in the work which was, in his opinion, not desirable. In this connection, Mr. Afzal Husain referred to the resolution passed at the Third International Locust conference held in London in September 1934 at which they laid emphasis on fundamental research in locust biology and locust physiology as the solution of many practical problems depended on it and considered it desirable that the attention of research laboratories should be concentrated on those problems which had the greatest value for the elucidation of the locust problems. He therefore suggested that clause (v) of paragraph 3 of the note referred to above should be amended in such a way that as long as the main locust research scheme was in existence the work at Lyallpur should also continue. Mr. Stewart said that if the Board agreed to the retention of the clause as it stood and if the Punjab Government put up a fresh application it should be treated as a continuation scheme and financed in preference to new schemes. Mr. Carpenter said that while he fully appreciated the reports of work done by Mr. Afzal Husain he was of the view that any continuance of this work should come up as a new item since otherwise it means giving it priority over the other schemes. He opined that Clauses (i), (ii) and (v) should be retained as they were. Mr. Allan said that the work was very important and it was desirable to continue it. Dr. Shaw said that the work done at Lyallpur was of all-India importance and did not concern the Punjab alone. The scheme should, in his opinion, be treated as a continuation scheme. Mr. Sethi enquired as to how far the object with which the work was started had been achieved. In reply, Mr. Burt said that it appears to the Locust Committee that the chief difficulty at the present moment was lack of material which was not likely to be plentiful till another invasion of locusts occurred. Mr. Afzal Husain explained that they were getting some material from Karachi and that if the scheme was continued they would have sufficient material to go on with it. He also referred to the fact that work of similar nature was also being done in London at the Cambridge University where they were getting the necessary material from Algeria by aeroplane. After discussion Mr. Burt moved that clause (v) should be amended to read as follows:—

“That this work should be continued and that an application for a grant accompanied by a research programme be invited from the Punjab Government”.

The motion was seconded by Mr. Allan. Mr. Carpenter said that he took it that if the application was received it must be placed before the Locust Committee first. The Chairman said that there would be no diffi-

culty on that score. Dr. Nazir Ahmad proposed that the following sentence be added to the amendment moved by Mr. Burt:—

“This application should be considered by the Board at its next meeting and, if approved, should be regarded as a continuation of the present scheme and an integral part of the larger scheme thus ensuring continuity of the work”.

The motion was seconded by Mr. Nizamuddin Hyder. Mr. Sethi moved a further amendment to the effect “that work should be continued on the present basis”. Mr. Sethi’s amendment was first to the vote and was lost by a majority. Dr. Nazir Ahmad’s amendment was then put to vote and was declared carried.

Clauses (i) and (ii) of the note were also then approved.

The question raised in clause (iii) regarding the form in which the final report on the work done by Mr. Afzal Husain should be published was then taken up. Mr. Burt said that this was the first case of publication of important completed work that had been done under the Council’s auspices and there was a difference of opinion in the Locust Committee as to whether it should be published in the form of a Monograph or in a series of articles in the journal. The Committee felt on the point of principle that this question should be considered and decided at a full meeting of the Board. Mr. Burt expressed his own view in favour of publishing the work in the form of a Monograph as that would enable the whole of the work done to appear together. Mr. Sethi enquired if the work had not been completed what would happen to that part of it which was not completed. Mr. Burt said that a great deal of the work done at Lyallpur had been carried as far as was possible until the next invasion of locusts occurred. The Committee therefore considered it desirable to publish what had already been completed and to leave the work not yet complete to be published later. Mr. Afzal Husain said that on the point of principle he quite saw the advantage of having in one publication the results of the work so far done. On the other hand, there was bound to be at least a year’s delay in preparing the whole volume and he felt that as very valuable data were available it might be published at once in the form of a series of articles. He referred to a letter which he had received from Mr. Uvarov in which the danger of doing the same work in different places was pointed out and from that point of view it was important to publish the results so far achieved without any delay. Besides, in his opinion, the scientist working on a problem was the best judge of the form in which the work should appear and should be allowed to use his discretion in a matter like this. Mr. Livingstone said that there was no finality in scientific matters and he considered that the work so far completed should be published in the form of a Monograph. After a good deal of discussion in which several members joined the Board agreed, at the suggestion of Mr. Stewart, that (a) a consolidated report of the work completed up to date should be published and (b) Mr. Afzal Husain should be permitted to publish scientific articles on completed work from time to time in the Council’s Journals. The Chairman then put the whole report of the Committee to the Board for consideration. The Board adopted the report with the modifications stated above.

5. Reference from Public Health Commissioner to the Government of India regarding a proposal from Major-General Sir R. McCarrison, Kt., C.I.E., K.H.P., I.M.S., Director, Nutrition Research, Indian Research

*Fund Association for a survey of food-material and their food values throughout India (Subject No. 18 of the Agenda). (Appendix XXIII).*

Colonel Russell opened the subject and explained the proposals which were contained in Annexure II to the note circulated on the subject. It was made clear that this proposal meant no financial liability on the part of the Council. Mr. Burt said that he had no doubt that a large number of members of the Board were interested in the subject. He was sure that the Imperial Council of Agricultural Research could get the assistance of all Agricultural Chemists in the various provinces in the matter. A good deal of information on the subject was already available in the Laboratories of the Agricultural Departments. Colonel Olver said that the matter had been discussed by the Animal Nutrition Committee that morning and he hoped that it would be possible to collect a good deal of information which would prove of practical value in animal nutrition research. Mr. Devadhar enquired whether the co-operation of non-officials interested in this work would be invited, to which Colonel Russell said that they would be glad to have non-official co-operation and assistance. Mr. Warth expressed the view that before this work was undertaken it would be necessary to specify in exact detail what analyses were really required. He had ample records of the usual analyses of foodstuffs but these did not include determinations of iron, manganese or rare elements in the ash. Rao Bahadur Viswanath said that a good deal of information was available but mainly in respect of raw materials only and not on cooked foods. He agreed with Mr. Warth that the results of ordinary analyses, but usually not of complete mineral analysis, were available. Dr. Shaw enquired whether it was proposed to carry out work on ordinary commercial samples of food grains or on samples obtained after botanical identification. He added that there were various kinds of the same food grains and if ordinary commercial samples were taken it would mean working not on one kind of article but on a mixture of several kinds of the same article. On the other hand if samples obtained after botanical identification were taken then work would be done on articles of known identity. Mr. Sethi said that for purposes of analysis we must take the bazaar samples which formed the food of the people and not the Pusa varieties. After a general discussion the Chairman enquired how far the Provincial and States Directors of Agriculture and Veterinary Services would be willing to co-operate in the work. The reply was that they would all be glad to give such co-operation as was required.

6. The meeting then adjourned till 11 o'clock on Saturday, the 23rd February 1935.

CHARAN DAS,  
*Secretary.*

DELHI;

*The 22nd February 1935.*

PROCEEDINGS OF THE MEETING OF THE ADVISORY BOARD OF  
THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH  
HELD AT DELHI ON SATURDAY, THE 23RD FEBRUARY 1935.

The following were present:—

1. Diwan Bahadur Sir T. VIJAYARAGHAVACHARYA, K.B.E., *Chairman.*
2. Mr. R. G. ALLAN.
3. Dr. B. K. BADAMI.
4. Rao Bahadur BHIMSHAI R. NAIK.
5. Mr. B. C. BURT.
6. Mr. P. H. CARPENTER.
7. Mr. J. N. CHAKRABARTY.
8. Mr. G. K. DEVADHAR.
9. Mr. T. J. EGAN.
10. Dr. T. EKAMBARAM.
11. Mr. E. S. FARBROTHER.
12. Mr. J. W. GRANT.
13. Dr. L. K. HYDER.
14. Mr. NIZAMUDDIN HYDER.
15. Dr. B. N. IYENGAR.
16. Mr. W. J. JENKINS (Attended in the afternoon only).
17. Mr. P. J. KERR.
18. Dr. V. N. LIKHITE.
19. Mr. A. M. LIVINGSTONE.
20. Mr. K. MCLEAN.
21. Brigadier H. S. MOSLEY.
22. Mr. A. M. MUSTAFA.
23. Dr. NAZIR AHMAD.
24. Colonel A. OLVER.
25. Mr. B. S. PATEL.
26. Mr. K. PARMESWARAN PILLAI.
27. Mr. T. F. QUIRKE.
28. Diwan Bahadur T. RAGHAVIAH.
29. Mr. S. V. RAMAMURTY.
30. Major P. B. RILLEY.
31. Mr. J. H. RITCHE.
32. Mr. G. P. SEN.
33. Mr. D. R. SETHI.
34. Dr. F. J. F. SHAW.
35. Mr. H. B. STEWART.
36. Mr. A. SUBRAMANYAN.
37. Rao Bahadur C. TADULINGAM.

38. Mr. C. N. VAKIL.

39. Mr. F. WARE.

40. Mr. K. K. WARRIAR.

Rai Bahadur Malik Charan Das, *Secretary*.

The following attended as visitors:—

1. Mr. M. AFZAL HUSSAIN.
2. Professor S. P. AGHARKAR.
3. Mr. D. V. BAL. (Afternoon only).
4. Mr. E. J. BRUEN.
5. Mr. J. R. HADDOW.
6. Dr. P. E. LANDER.
7. Mr. C. MAYA DAS. (Afternoon only).
8. Mr. T. J. MIRCHANDANI.
9. Professor J. N. MUKHERJEE. (Afternoon only).
10. Mr. G. B. PAL. (Afternoon only).
11. Professor P. PARIJA.
12. Dr. L. A. RAMDAS.
13. Mr. K. RAMIAH.
14. Rao Bahadur D. L. SAHASRABUDDHE. (Afternoon only).
15. Rao Bahadur B. VISWANATH.
16. Mr. F. J. WARTH.

2. The meeting commenced at 11 A.M. and adjourned at 5 P.M. with an interval for lunch from 1-30 P.M. to 3 P.M.

3. *Annual report on the working of the rice research scheme in Bengal for the year 1933-34. (Subject No. 5 of the Agenda). (Appendix XXIV-A).*

*Annual report on the working of the rice research scheme in Burma for the year 1933-34. (Subject No. 6 of the Agenda) (Appendix XXIV-B).*

*Annual reports on the working of the rice research schemes in Madras and United Provinces for the year 1933-34 and in the Central Provinces for the period September 1932—March 1934 (reports already circulated to the Advisory Board with this Department Memorandum No. F. 229/34-A., dated 8th November 1934. (Subject No. 7 of the Agenda). (Appendix XXIV-C).*

Mr. Burt introduced the report of the Committee (Appendix XXIV) appointed to consider these reports and draw attention to the recommendation of the Committee regarding the desirability of observing a general standard of size for proper reports on rice research schemes. He moved the adoption of the report; the motion was carried.

4. *Annual report on the working of the Agricultural Meteorology Branch, Poona, for the second year ending 21st August 1934. (Subject No. 9 of the Agenda). (Appendix XXVI).*

Mr. Burt introduced the subject and moved that the report (Appendix XXV) of the Agricultural Meteorology Sub-Committee relating to this subject be adopted. Mr. Ramamurthy pointed out that Local Governments

did not seem to realise the importance of agricultural meteorology and suggested that their attention might be drawn to this and they might be asked to open more agricultural meteorological stations. Dr. Nazir Ahmad expressed the opinion that if Mr. Ramamurty's suggestion was adopted it would be necessary to make some arrangements for the training of provincial officers in agricultural meteorology. Mr. Afzal Hussain suggested that officers from the Agricultural Meteorological Branch might be given lectures at provincial Agricultural Colleges. Dr. Ramdas said that they had at Poona sufficient facilities for training any officers who might be sent from provinces for the purpose and they would welcome them. This arrangement would, in his opinion, be more economical than any other arrangement. The Chairman promised that the importance attached by the Board to the matter would be brought to the notice of Local Governments and that the Director General of Observatories and the Industries and Labour Department would be consulted on the suggestions made. The report was adopted.

5. *Report on the deputation abroad of Dr. B. N. Uppal, Plant Pathologist to the Government of Bombay, for the study of virus diseases of plants. (ii) Revival of Dr. Uppal's scheme of investigations into the virus diseases of plants originally sanctioned by the Council, with certain modifications introduced by Dr. Uppal as a result of his deputation abroad. (Subject No. 12 of the Agenda). (Appendix V).*

Mr. Burt explained the modifications in the scheme and the recommendations (Appendix XXVII) of the plant diseases Sub-Committee which had examined it. The Board approved of the report and of the proposals for the revival of the scheme as recommended by the sub-committee.

6. *Application from the Government of Travancore for a grant of Rs. 92,850 spread over five years for a scheme for the investigation of the 'root disease' of the coconut palm in South India (Subject No. 20 of the Agenda). (Appendix VIII).*

Mr. Burt moved the adoption of the Sub-Committee's report (Appendix XXVII). Mr. Parameswaran Pillai supported the scheme as modified by the Sub-Committee and said that the Travancore State would provide all necessary equipment for the carrying out of the scheme including microscopes, etc., as recommended by the Sub-Committee. The motion was supported by Dr. Nazir Ahmad and Messrs. Ramamurty and Devadhar. Mr. Burt said that the financial effect of the changes recommended by the sub-committee was that the scheme as modified would cost approximately Rs. 7,500 per year or Rs. 23,000 in round figures over a period of three years against Rs. 92,880 over a five year period which was the cost of the original scheme as submitted by the Travancore Government. The scheme as modified by the sub-committee was approved.

7. *Application from the Government of the Central Provinces for a grant of Rs. 35,500 spread over a period of five years for a scheme of research work on paddy cultivation. (Subject No. 24 of the Agenda). (Appendix XXVIII).*

Mr. Ritchie introduced the scheme and moved the adoption of the recommendations (Appendix XXVII) of the sub-committee. The motion was carried.

8. *Application from the Government of Bombay for a grant of Rs. 37,510 spread over five years for a scheme for the investigation of the attack on*

itobacco by the phanerogamic parasite 'Orobanche'. [Subject No. 25(b) of the Agenda]. (Appendix XXIX).

Mr. Patel introduced the scheme and said that he had nothing to add to what the sub-committee had stated in its report (Appendix XXVII). Mr. Stewart enquired whether the committee considered the point that much of the work proposed in the scheme was very largely of academic interest and of no economic importance. He suggested that when information in regard to the work already carried out in other countries had been obtained as recommended by the Sub-Committee the scheme would very probably not be necessary at all. Mr. Burt referred to the second sentence of the sub-committee's report in which the Committee had expressed a doubt as to whether the proposed programme of research work would lead to more satisfactory methods of dealing with this parasitic weed than those already in use. The recommendation of the committee to postpone the scheme till the next meeting of the Advisory Board and to obtain further information on the subject was approved.

9. *Application from the Government of Bombay for a grant of Rs. 49,360 spread over five years for a scheme for investigation into the attack on jowar by the parasite 'Cttriga'.* [Subject No. 25(a) of the Agenda]. (Appendix XXX).

The report (Appendix XXVII) of the sub-committee was adopted.

10. *Application from the Government of Bombay for a grant of Rs. 1,22,310 spread over a period of ten years for research in goat breeding in the Bombay Presidency.* (Subject No. 15 of the Agenda). (Appendix XXXII).

Mr. Bruen introduced the scheme and referred to the changes recommended (Appendix XXXI) therein by the Cattle Breeding Committee. Colonel Oliver explained that the scheme was part of a co-ordinated scheme of goat breeding for all-India and that the committee's recommendations had secured a saving of Rs. 25,000. Mr. Devadhar enquired whether there was any possibility of inviting co-operation in regard to this scheme from the Co-operative Societies and was informed that when the scheme had been sanctioned and suitable breeds of goats had been developed the question of co-operating with Co-operative Societies would only then arise. Mr. Stewart enquired whether Bombay goats were being used in any other province to which Mr. Bruen replied in the affirmative and said that goats were being imported from Bombay into Madras and the surrounding States. Mr. Devadhar added that Surti goats of the Bombay Presidency were being used at the rural uplift centre in Travancore. Mr. Carpenter raised the point that the contribution promised by the Government of Bombay was inadequate and that the Local Government was not very enthusiastic about it. Mr. Allan said that they in the United Provinces had always been under the impression that before a scheme could have any chance of success an adequate contribution should be provided by the Local Government concerned. For this reason many schemes submitted to him had not been sent up. If, as in the case of Bombay, a small contribution would be sufficient for a scheme to be passed then the United Provinces Government would be able to send up a very large number of schemes. Rao Bahadur Bhimbhai R. Naik said that the financial position of the Bombay Government was not at all satisfactory but the scheme was important not only from the point of view of Bombay but from the point of view of several other provinces to which Bombay goats were being

imported. He recommended therefore that the scheme be passed. Mr. Bruen, referring to the point raised by previous speakers about the inadequacy of the Bombay Government's contribution, said that, apart from cash contribution of Rs. 7,100 for non-recurring expenditure promised by the Bombay Government, his own supervision and that of his staff and 250 acres of land for buildings which would be provided by the Local Government should be regarded as contribution of the Local Government. Colonel Olver pointed out that after taking into account the reductions recommended by the committee the cost of the scheme would come down to Rs. 72,000. This was apart from the supervision of Mr. Bruen and his staff and the two Experts belonging to the Missionary Organisation who would be provided without payment. Mr. Stewart said that the items of expenditure to be provided by the Local Government were not new items of expenditure. The point was then raised that receipts amounting to Rs. 45,600 were estimated and in addition property worth Rs. 9,970 consisting of livestock and structures would be left on the conclusion of the experiments. The Chairman enquired whether the Director of Agriculture, Bombay, would, on behalf of his Government, be prepared to guarantee the receipts. Mr. Patel said that that was not possible because the present estimate of receipts was based on existing conditions but those conditions were always liable to change. Mr. Devadhar suggested writing to the Bombay Government to ascertain whether they would make any larger contribution to which Mr. Patel replied that that was not likely owing to financial difficulties of the Bombay Government. Dr. Hyder said that in view of the importance of the scheme he would support it on the condition that the Government of Bombay agreed to make a further contribution of Rs. 4,240 on account of the purchase of foundation stock including transport charges at Poona. In reply to an enquiry from the Chair, Mr. Patel promised to try his best to persuade his Government to provide this amount. Mr. Devadhar seconded Dr. Hyder's motion. Mr. Burt said that the scheme was a good one and should go through but he objected to the Council being asked to carry on the risks. He moved another amendment to the effect that the scheme be sanctioned on the condition that the Government of Bombay guarantee the receipts promised by them. In other words, the Council should make a grant of the amount representing the estimated cost minus the amount of estimated receipts, *viz.*, Rs. 45,600 the rest of the cost being met by the Local Government. The amendment was seconded by Mr. Sethi. Thereupon Dr. Hyder withdrew his amendment with the concurrence of Mr. Devadhar, the seconder. Mr. Patel said that so far as he could see it would be very difficult for the Government of Bombay to satisfy the condition of guaranteeing receipts because it depended on several factors beyond the Local Government's control and the receipts were always liable to change. Mr. Bruen said that he was sure that the Government of Bombay would not be able to agree to the condition of guaranteeing receipts and rather than have the scheme turned down he would withdraw it. Dr. Hyder then enquired whether it would be possible to cut out the station at Poona from the scheme so as to reduce the cost to which Mr. Bruen replied in the negative. Colonel Olver also did not favour this suggestion. Mr. Patel moved another amendment similar to that originally moved by Dr. Hyder and subsequently withdrawn. *viz.*, that the scheme be sanctioned on the condition that the Government of Bombay do provide a further contribution of Rs. 4,240 on account of the purchase of foundation stock at Poona. This amendment was seconded by Mr. Devadhar and was put to the vote first. It was declared carried.



11. *Application from J. J. De Valois of the Agricultural Institute, Katpadi, for a scheme of research on goat breeding at a cost not exceeding Rs. 84,172 (Rs. 5,480 non-recurring and 78,692 recurring) spread over a period of ten years. (Subject No. 38 of the Agenda). (Appendix XXXIII).*

Mr. Ramamurty introduced the scheme which was supported by Dr. Ekambaram. The scheme was carried as recommended by the Cattle Breeding Committee. (Appendix XXXI).

12. *Application from the Government of Bombay for a scheme of research in Poultry Husbandry to be conducted in the Bombay Presidency at a cost not exceeding Rs. 61,053 (Rs. 22,023 non-recurring and Rs. 39,030 recurring) spread over a period of 5 years. (Subject No. 16 of the Agenda). (Appendix XXXIV).*

Mr. Bruen introduced the scheme. Colonel Olver referred to the report (Appendix XXXI) of the Cattle Breeding Committee on this subject and moved its adoption. Mr. Sethi agreed with Mr. Bruen that this was an important scheme but said that work on poultry was being done in other provinces also and the best way of proceeding with further work would be to ask all the provinces as to what work they were doing already and what was still required and whether whatever further work was required could not be done at a Central Poultry Institute. Mr. Carpenter supported Mr. Sethi's idea of making enquiries from other provinces with a view to having one centre for work of all-India importance. This would not delay the scheme inasmuch as replies would come before the next meeting of the Advisory Board which will be held before the next meeting of the Governing Body. Mr. Ramamurty agreed with Mr. Sethi and added that what they required was a better organisation and not new breeds. If a reference was made to provinces this point should be included. The Chairman said that the proposal was that the present scheme be kept in abeyance until the views of Local Governments had been received on the question of establishing a Central Poultry Institute. Mr. Bruen opposed this idea saying that other provinces had had time to put up schemes and had not done so. He thought that the scheme which the Bombay Government had taken trouble to put up should be considered and allowed to go through. Mr. Sethi was of the view that the work proposed in the scheme was of all-India importance and the best course, in his opinion, was for all the provinces to put their heads together and consider what was the best method of doing the work. After further discussion the Board agreed that the scheme should be kept in abeyance till opinions had been invited and received from provinces both as to the work required and the necessity of having a Central Poultry Institute in India.

13. *Application from the United Provinces Poultry Association for a grant for research into the preservation and handling of eggs and poultry prior to their disposal in the market at a cost not exceeding Rs. 32,570 (Rs. 5,784 non-recurring and Rs. 26,786 recurring) spread over a period of three years. (Subject No. 40 of the Agenda). (Appendix XXXV).*

The scheme was introduced by Mr. Egan. Colonel Olver said that the scheme had been very carefully considered by the Cattle Breeding Committee which had found (Appendix XXXI) that facilities for this sort of work were ample in the United Provinces. As regards the idea that this work might be done at a Central Poultry Institute he said that this would take time. The work involved in the present scheme was small and definite

and he moved the adoption of the Committee's report (Appendix XXXI). Mr. Sethi could not see what would be lost by waiting till the replies from the Local Governments in regard to the necessity of a Central Poultry Institute had been received. He therefore thought that, like the previous scheme, this should wait till the next meeting of the Advisory Board. Dr. Nazir Ahmed said that the results of this scheme would be applicable to all provinces and thought that we need not wait for replies of Local Governments. Mr. Ware thought that although the scheme was of all India importance there was no harm in waiting for six or seven months. Mr. Sethi said that he was not at all against the scheme but his only object in suggesting a reference to Local Governments was that the Council's funds were very limited and his idea was to spend them to the best advantage. He was therefore definitely of the opinion that we should first find out from the provinces what work was required and what was the best place for carrying it out. Mr. Burt was of the view that the scheme was a very practical one and should be sanctioned without hesitation. Diwan Bahadur Raghaviah agreed with Mr. Burt's view. Mr. Ware suggested that the scheme might be referred to an *ad hoc* committee of the Board at its next meeting by which time it was hoped that the information from provinces would have been received. The Board approved of this proposal.

14. *Proposal for the establishment of a Central Animal Nutrition Institute. (Subject No. 49 of the Agenda). (Appendix XXXVI).*

Colonel Olver introduced the subject and explained that the subject had been under consideration since 1929 but for financial reasons it had so far been found not possible to get anything done. Mr. Ware supported the idea of the establishment of the proposed Institute and said that it was stated in the first annual report of the Agricultural Research Council in England that it had been found necessary to consider Animal Health, Animal Nutrition and Animal Genetics together and the same organisation was required in this country. For this reason the proposal had been made to the Standing Animal Nutrition Committee that the proposed Central Animal Nutrition Institute should be located at Izatnagar and this had been accepted. Mr. Warth, in further supporting the idea, referred to the importance of the programme of proposed work which had been explained in the report of the Standing Animal Nutrition Committee on the subject. Mr. Carpenter referred to the last sentence of the Committee's report where it was stated *inter alia* that the Physiological Chemist should be asked to prepare a scheme for submission to the Education, Health and Lands Department through the Director, Imperial Institute of Agricultural Research. As Mr. Warth, the Physiological Chemist, would be leaving India shortly and it was not certain as to when his successor would be appointed and whether the successor would be suitable for preparing the scheme in question he suggested that the wording should be changed so as to request the Director, Imperial Institute of Agricultural Research, to prepare the scheme. Dr. Shaw agreed with this and promised to prepare the scheme in consultation with the Physiological Chemist, and others with experience of such work. Mr. Ramamurty enquired whether this would be a section of the Imperial Institute of Agricultural Research to which Mr. Ware replied in the negative. The Chairman pointed out that there were three possible alternatives for the proposed Institute, *viz.*, (1) under the Director, Imperial Institute of Agricultural Research, Pusa; (2) under the Director, Imperial Institute of Veterinary Research, Muktesar; and (3) as an independent Institute. Colonel Olver expressed the opinion

that the Institute was required to deal with nutrition problems adequately and for this purpose an independent Institute would be necessary. The Committee's report was adopted with the verbal modification stated above.

15. *Application from the Government of the United Provinces for a grant of Rs. 1,96,720 spread over 5 years for research into the feeding of cattle at the Departmental farms. (Subject No. 47 of the Agenda). (Appendix XXXVII).*

Colonel Olver introduced the Committee's report (Appendix XXXVII-A) which was adopted.

16. *Application from the Government of the United Provinces for a grant of Rs. 10,000 spread over three years for undertaking cotton seed crushing and supply of decorticated cake for educative propaganda. (Subject No. 21 of the Agenda.) (Appendix IX).*

The Chairman announced that information had been received from Mr. Tait, Central Publicity Officer, Indian State Railways, as promised by him at the meeting on the 18th February 1935 in regard to the railway transport charges from Navasari to Cawnpore (United Provinces), Lyallpur (Punjab), Madras, Calcutta, Patna and also from Cawnpore to the same centres. Mr. Patel was then asked to state the result of the enquiries which he undertook on the previous occasion to make telegraphically from the firm at Navasari. Mr. Patel then read out a telegram from the firm at Navasari to the effect that the firm were able to undertake supply of cotton seed cake at the rate of Rs. 87-8 per ton including packing at Navasari station. It was realised in the course of discussion that at this rate the idea of getting supplies from that firm was not a practical proposition inasmuch as railway freight from Navasari was very high except to Madras and cotton seed always more expensive in Gujerat than in Cawnpore. It was further explained that the proposal in the scheme did not involve any expenditure to the funds of the Council apart from a guarantee against loss amounting to Rs. 10,000 in all. As the United Provinces Government were providing the capital the scheme was then approved as it stood.

17. *Scheme of research on sunn hemp manufactures in Bombay. (Subject No. 27 of the Agenda). (Appendix XXXVIII).*

Mr. Burt moved the adoption of the report of the Sunn Hemp Committee (Appendix XXXVIII-A) which recommended that the scheme be rejected. The motion was carried.

18. *Application from the Director General of Observatories, Poona for a grant of Rs. 1,39,000 spread over five years for a revision and extension of the present scheme of agricultural meteorology already sanctioned by the Imperial Council of Agricultural Research. (Subject No. 32 of the Agenda). (Appendix XXXIX).*

It was decided to adopt the recommendation of the Agricultural Meteorology Sub-Committee (Appendix XXV) in regard to this scheme, viz., that the scheme be continued for the two years remaining of the five years period for which it was originally sanctioned. The Board also decided that the question of further continuance of the scheme should be considered by the Council's Secretariat in consultation with the Departments concerned. The recommendations of the Committee in regard to the small additions which it is proposed to be made to the staff etc., were also approved. The Committee's report was adopted.

19. *Proposal to appoint provincial dairy committees. (Subject No. 39 of the Agenda). (Appendix XL).*

The scheme was introduced by Colonel Olver who explained the recommendations of the Standing Dairy Committee of the Council on this subject. Mr. Livingstone said that this arose out of the recommendations of the Provincial Economic Conference held in April 1934. At its last meeting the Advisory Board felt that something should be done in the direction of appointing provincial dairy committees but the subject was postponed till the present meeting so as to give time for Provincial Directors to see how best committees of the nature proposed could be fitted in with existing provincial committees and boards dealing with livestock improvement and marketing. Mr. Bruen thought that the establishment of the proposed Committee would interfere with the work of the animal husbandry section of the agricultural department in his province and he therefore did not favour them. In his opinion these committees, if established, should deal with milk and milk products alone and they should have nothing to do with breeding work. The general sense of the meeting was that there was no need for these committees and the proposal was rejected.

20. *Report of the Potato Committee on technical details of the scheme for potato research in Northern India sanctioned by the Governing Body. (Subject No. 43 of the Agenda). (Appendix XLI).*

The report of the Potato Committee was recorded.

21. *Reconstitution of those sub-committees of the Imperial Council of Agricultural Research, appointed under Rule 30, which have been in existence for two years or more. (Subject No. 44 of the Agenda). (Appendix XLII).*

*Locust Committee.*—The Vice-Chairman having explained that since the last locust visitation ceased, the various administrative officers had not attended and that for the present only a technical sub-committee was needed, the Board approved of the following revised constitution for this committee:—

Vice-Chairman, Imperial Council of Agricultural Research . . . .  
Chairman (*ex-officio*).

Agricultural Expert, Imperial Council of Agricultural Research.

Director of Agriculture, Punjab.

Chief Agricultural Officer, in Sind, Karachi.

Entomologist to Government, United Provinces.

The Imperial Entomologist.

Entomologist to Government, Punjab.

Agricultural Officer, N.-W. F. Province.

Secretary, Imperial Council of Agricultural Research . . . Secretary  
(*ex-officio*).

*Indian Oil Crushing Industry.*—Committee.

The Board recommended that the designation of the committee be changed from the Indian Oil Crushing Industry Committee to Indian Oil Seeds and Vegetable Oils Committee. In regard to the constitution, Mr. Ramamurty suggested that Oil Seeds Specialists and Directors of Agriculture of provinces growing oil seeds should be added to the Committee. Mr. Burt explained that if all these were added as suggested by

Mr. Ramamurty the Committee would be swamped with officials which was not very desirable. He thought therefore that the Committee might continue with its present composition till the question of appointing a statutory committee, proposals for which were under consideration of Government, was settled. Mr. Ramamurty said that the present Committee was not suitable for scrutinising any oil seeds scheme that came to the Council. The Chairman suggested that until the question of a statutory committee was settled the present committee might continue with the addition of such of the Directors of Agriculture and Oil Seeds Specialists in provinces as might be invited by the Vice-Chairman of the Council to any meeting at which their presence might be considered necessary. This proposal was carried.

*Sugar Committee.*—The Board decided (1) to appoint the Director, Imperial Institute of Agricultural Research, *Ex-officio*, (2) that all present co-opted members should be full members. There was a discussion on two points:—

- (a) Whether the representatives of the Sugar Producers' Association and Sugar Mills Association should be appointed by name or not. It was decided to make no change.
- (b) Whether K. B. Mohammad Hadi, who never attends, should remain a member. It was agreed that he should as he takes an active interest in sugar, though he has retired from Bhopal.

*Fertilizers Committee.*—The following changes were made in the constitution of this Committee:—

No. 7, Rao Bahadur B. Viswanath, Agricultural Chemist to the Government of Madras, should read The Agricultural Chemist to the Government of Madras. No. 9 should read, The Imperial Agricultural Chemist, No. 11 Mr. D. R. Sethi, Director of Agriculture, Bihar and Orissa, should read Director of Agriculture, Bihar and Orissa.

The following were added to the Committee:—

- Agricultural Chemist, Bihar and Orissa.
- Agricultural Chemist, Central Provinces.
- Agricultural Chemist, Sind.

22. *Proposals for future research on the insect pests of sugarcane.* (Subject No. 45 of the Agenda). (Appendix XLIII).

Mr. Burt explained that the matter was for information only at the present moment. As stated in the note circulated on the subject a revised scheme was under preparation and would be submitted to the Board at a subsequent meeting. This was noted.

23. *Appointment of Provincial Committees for the definition of Breed characteristics.* (Subject No. 46 of the Agenda). (Appendix XLIV).

Colonel Olver introduced the report (Appendix XLIV-A of the Cattle Breeding Committee on this subject and referred to the recommendations of the Committee that in order to carry out the work properly it was essential to have a specially selected officer with wide knowledge of the different breeds of cattle in India who would carry out a survey of breeds which it was proposed to organise in consultation with breeders and others who had local knowledge of breeds. Mr. Bruen supported the recommendation of the committee. The general feeling of the members was, however, against the appointment of a special officer inasmuch as there were officers

in almost all provinces who have been doing the work and could be trusted to carry out the surveys required. Colonel Olver explained that information was to be collected on an all-India basis and that if work was done provincially then it would be difficult to classify the various breeds on a common basis. He thought therefore that the best course was to do the work centrally. In reply to an enquiry from the Chair Mr. Livingstone said that the Marketing Officers can classify animals according to their given type as milking, draught etc., but would not be able to classify them according to breed. He suggested, however, that we might wait till the Marketing Officers had had some experience of the work and were in a position to know what they could do. On the matter being put to the vote the recommendation to appoint a special officer for this work was lost. The question of the appointment of provincial committees for the definition of breed characteristics was postponed till replies from Local Governments to the reference made by the Council's secretariat to all Local Governments had been received. It was decided to bring the matter before the next summer meeting of the Board.

24. *Proposal for the appointment of a Disease Investigation Officer for Sind and Ajmer Marwara. (Subject No. 48 of the Agenda). (Appendix XLV).*

Colonel Olver explained the necessity of appointing a separate Disease Investigation Officer for Sind and Ajmer-Marwara. It was stated in the course of discussion that the Disease Investigation Officer employed in Bombay was not doing the work for Sind and Ajmer-Marwara. The proposal was carried.

25. Mr. Carpenter said that the Old Council Secretariat Hall, Old Delhi, in which the present meetings of the Board were held was very convenient and had the further advantage of good acoustics. He suggested that in future meetings should be held there if possible. This was noted.

26. Rao Bahadur Tadulingam expressed the feelings of thankfulness on behalf of the members of the Board for the kind hospitality extended to them by the Chairman and for the helpful guidance which he gave them during the meetings. He also expressed appreciation on behalf of the Board of the work done by the staff and particularly that of Rai Bahadur Charan Das, Secretary, who was now due to retire in the course of the next month. The Chairman said that he fully associated himself with this appreciation of the Secretary's work. Rai Bahadur Charan Das had replaced an I. C. S. Secretary and had done very hard work for the last three years. He had been an able and efficient Secretary and had fully justified his appointment. He had in fact enhanced the prestige of the Imperial Secretariat Service to which he belonged.

27. Mr. Devadhar moved a vote of thanks to the Chair which was carried with acclamation. After the Chairman had responded, the meeting terminated.

CHARAN DAS,  
Secretary.

NEW DELHI;  
The 24th February 1935.

## APPENDIX I.

NOTE DATED THE 13TH FEBRUARY 1935, BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT NO. 1 :—DECISIONS OF THE GOVERNING BODY ON THE RECOMMENDATIONS OF THE ADVISORY BOARD MADE AT THE LATTER'S MEETINGS HELD IN FEBRUARY AND SEPTEMBER 1934.

1. Scheme for the investigation of the life-history, Bionomics and development of fresh water fishes of Bengal by Dr. H. K. Mookerjee of the Calcutta University at a cost of Rs. 7,870 spread over a period of three years.

Sanctioned.

2. Application from the Government of Bengal for an extension of the scheme of research on the mechanical analysis of lateritic soils and the nutrition of the rice plant at the Dacca University. (Grant recommended by Advisory Board Rs. 37,104 spread over three years).

Grant recommended by the Advisory Board was sanctioned.

3. Application from the Government of the United Provinces for a grant of Rs. 33,000 spread over a period of 3 years for undertaking experiments to investigate the possibilities of commercial utilization of linseed fibre from straw after harvesting the seed.

Sanctioned.

4. Application from the Government of Madras for a grant of Rs. 45,000 spread over a period of five years for a scheme of research work on the chemistry of sugarcane.

Provisionally sanctioned subject to the circulation of details to the Governing Body. The proposal that the scheme should be entrusted to the Imperial Agricultural Chemist, Imperial Institute of Agricultural Research, was also approved.

5. Scheme of research work on the developmental morphology and anatomy of sugarcane sorghum hybrids and of the Indian sugarcane and wild saccharums costing Rs. 7,500 spread over a period of three years, to be carried out by Professor Ekambaram of the Madras University.

Sanctioned.

6. Application from the Government of the Punjab for a grant of Rs. 1,73,970 spread over five years for a scheme for research on the water requirements of crops under canal irrigated conditions (revised scheme).

Sanctioned.

7. (a) Application from the Government of Madras for a grant of Rs. 1,500 spread over three years for a scheme of experiments for the improvement of sunn-hemp fibre at the Agricultural Research Station, Samalkota.

Sanctioned.

(b) Application from the Government of Bombay for a grant of Rs. 1,500 spread over three years for research work on sunn-hemp in the Bombay Presidency.

Sanctioned.

(c) Application from the Government of the Central Provinces for a grant of Rs. 20,060 spread over five years for a scheme of research work on sunn-hemp in the Central Provinces. (Grant recommended Rs. 10,660 spread over five years).

Grant recommended by the Advisory Board was sanctioned.

(d) Application from the Government of Bihar and Orissa for a grant of Rs. 1,440 spread over three years for research work on sunn-hemp in Bihar and Orissa.

Sanctioned.

8. Question of the duration of appointment of members of sub-committees appointed by the Governing Body under Rule 30 of the Rules and Regulations of the Imperial Council of Agricultural Research.

The recommendation of the Advisory Board that the period of membership be fixed at two years was approved.

9. Application from the Baluchistan Administration for a grant of Rs. 49,600 spread over a period of five years for a scheme for establishing a 'canning and fruit preserving research laboratory' at the fruit experiment station, Quetta.

Sanctioned.

10. Application from the Government of the Central Provinces for a grant for research on the Orange crop of the Central Provinces. (Grant recommended by the Advisory Board Rs. 71,160).

Grant recommended by the Advisory Board, was sanctioned.

11. Application from His Exalted Highness the Nizam's Government, Hyderabad, for a grant of Rs. 58,610 spread over a period of five years for a fruit research scheme. (Grant recommended by the Advisory Board Rs. 33,160).

The scheme as modified by the Advisory Board, was approved.

12. Application from the Government of the Punjab for a grant of Rs. 57,430 spread over a period of 3 years for a scheme of research work on Citrus Stock and Grape Vines in the Punjab.

Sanctioned.

13. Application from the Government of the Punjab for a grant of Rs. 35,052 spread over a period of three years for a San Jose Scale survey in the Punjab. (Grant recommended by Advisory Board, Rs. 22,512 spread over two years)

Grant recommended by the Advisory Board was sanctioned.

14. Application from the Government of Bengal for a continuation grant of Rs. 18,800 spread over a period of three years for research into properties of colloid soil constituents by Professor J. N. Mukherjee of the Calcutta University.

Sanctioned.

15. Application from the Government of the Punjab for a grant of Rs. 13,120 spread over three years for a scheme to investigate the changes in Microflora of Kallar and Alkaline Soils during reclamation, by Dr. S. Jag Jiwan Singh, M.Sc., Ph.D.

Sanctioned.

16. Application from the Government of Bengal for a grant of Rs. 43,152 spread over three years for a scheme of research work on the Physiology of the rice plant by Dr. S. P. Agharkar of the Calcutta University.

The recommendation of the Advisory Board, that the scheme be not sanctioned, was approved.

17. Application from the Government of the Central Provinces for a grant of Rs. 10,088 spread over four years for research work on the 'Gangai' pest of Rice—Entomological Work under the scheme of Rice Research already sanctioned by the Council for the Central Provinces.

The Advisory Board's recommendation that the work should be undertaken by the Entomological Section of the Imperial Council of Agricultural Research was approved, and the scheme put up by the Director, Imperial Institute of Agricultural Research in this respect, which had been recommended by the Advisory Board was sanctioned at a cost of Rs. 6,000 spread over two years.

18. Application from the Imperial Institute of Veterinary Research, Muktesar, for a grant for the appointment of a research officer, and staff for investigation into contagious abortion in cattle, goats and sheep.

Sanctioned on the understanding that if a suitable Indian for the post could not be obtained by the Public Service Commission, the matter should be resubmitted to the Governing Body.

19. Scheme for the extension of the Botanical sub-station at Karnal for a period of five years from September 1935 at a cost of Rs. 1,54,512.

Sanctioned.

20. Application from the Director, Imperial Institute of Agricultural Research, Pusa, for a grant of Rs. 29,560 spread over five years for a scheme for research on the Cytology of Indian crops at Pusa.

Sanctioned.



21. Scheme from the Government of Madras for investigation into the quality of rice

Sanctioned.

22. Application from the Government of Bengal for a grant of Rs. 21,600 spread over five years for a scheme of research on the Bio-Chemical and Physico-Chemical properties of rice at the Bio-Chemical Laboratory of the Dacca University.

Sanctioned with the modifications in the programme of work recommended by the Advisory Board.

23. Application from the Government of Bihar and Orissa for a grant of Rs. 8,490 spread over three years for a scheme for Bio-Chemical Research on Paddy.

The Scheme as modified by the Advisory Board was sanctioned, at a cost of Rs. 7,740.

24. Application from the Government of Madras for a grant of Rs. 37,500 (Rs. 2,630 non recurring and Rs. 34,950 recurring) spread over a period of ten years for sheep breeding research in Madras.

Sanctioned.

25. Application from the Government of Bengal for a supplementary grant of Rs. 15,571 in connection with the appointment of a Physiological Chemist to study animal nutrition problems at Dacca.

Sanctioned.

26. Application from the Government of the North-West Frontier Province for a grant of Rs. 27,350 spread over a period of five years for research on the improvement of fruit culture in the North-West Frontier Province and the problem of marketing.

The Advisory Board's recommendation that a grant of approximately Rs. 20,000 for the five years period be made, was approved.

27. Application from the Government of Madras for a grant of Rs. 74,000 spread over five years for a scheme of research work on bananas.

The scheme as modified by the Advisory Board was approved at a cost of Rs. 69,095.

28. Application from the Government of the United Provinces for a grant for the continuance of the investigations on Cereal Rusts by Dr. K. C. Mehta, Professor of Botany, Agra College, for a further period of three years from 1935. (Grant recommended by the Advisory Board Rs. 1,35,000).

The grant as recommended by the Advisory Board was sanctioned.

29. 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.

Postponed pending receipt from the Madras Government of full facts on the continuance of the survey of deep-sea fishing resources.

30. (1) Recruitment of a candidate in India for training abroad on the technique of fruit research, especially the alternate year bearing problem of fruit trees, for appointment as Physiological Botanist in the Fruit Research scheme in Bihar and Orissa.

(2) Appointment of two scientific assistants under the scheme of Fruit Research in Bihar and Orissa during the period of training abroad of the Physiological Botanist.

The Scheme had already been sanctioned but certain modifications proposed by the Advisory Board were approved by the Governing Body at its meeting held in January, 1935.

31. Proposals regarding the appointment of marketing staffs in the Provinces and the Constituent Indian States.

The recommendation of the Advisory Board that a grant of Rs. 20,000 per annum for 5 years to each Province except the North-West Frontier Province and Assam for which a grant of Rs. 10,000 each was recommended, was approved. No decision was

taken on the recommendation of the Board regarding the provision of suitable financial grants to the constituent states of the Council for the purpose of marketing investigations already decided upon in British Indian Provinces.

32. Research programme on tobacco having due regard to the scheme of work already sanctioned and to the need for further work on other types of tobacco and in the provinces.

Formulation of a co-ordinated programme of agricultural research for the improvement of the tobacco crop in India.

Approved.

33. Application from the Government of Assam for a grant of Rs. 47,972 spread over a period of three years in connection with a scheme for investigation into vaccination of cattle against rinderpest.

Postponed *Sine die*.

34. Application from the Government of Mysore for a grant of Rs. 88,880 spread over a period of five years for a scheme for fruit cultivation in the Mysore State.

The scheme modified by the Advisory Board at a cost of Rs. 46,200 was approved.

35. Potato Breeding scheme for Northern India.

Approved.

36. Application from the Andhra University for a grant of Rs. 5,000 spread over a period of two years for a scheme to investigate the commercial production of sweet potato starch by Dr. D. G. Walawalkar, B.Ag., M.Sc., Head of the Department of Technology, Andhra University.

The recommendation of the Advisory Board that the scheme be rejected, was approved.

37. Application from the Government of Bombay for a grant of Rs. 48,916 spread over a period of two years for a tractor ploughing scheme for the eradication of Hariali in deep black cotton soils.

Postponed.

38. Application from the Government of Bengal for a grant of Rs. 5,000 spread over two years for a scheme for investigating the Biology, Anatomy and development of pulse beetles (*Bruchidae*) with special reference to remedial measures against these pests, by Mr. D. D. Mukherjee, Lecturer in Zoology, University College of Science and Technology, Calcutta.

The recommendation of the Advisory Board that the scheme be rejected was approved.

39. Printing of Progress Reports on Research Schemes.

The recommendations of the Advisory Board were accepted.

40. Proposal for the appointment of Standing Committees on Rice and Wheat under the Imperial Council of Agricultural Research.

Approved.

## APPENDIX II.

NOTE DATED THE 14TH FEBRUARY 1935, BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT NO. 2 :—APPOINTMENT OF COMMITTEES.

1. *Rice Sub-Committee.*—There are certain progress reports on rice research schemes which are included in the agenda for the consideration of the Advisory Board. The Vice-Chairman to the Council considers that it will be an advantage to have them all examined in the first instance by the Committee of the Board which examined similar reports at the last meeting of the Board held in September 1934, and which consisted of the following gentlemen:—

The Vice-Chairman, Imperial Council of Agricultural Research, Chairman, *ex-officio*.

The Agricultural Expert, Imperial Council of Agricultural Research.

The Director of Agriculture, Madras.

The Director of Agriculture, Bombay.

The Director of Agriculture, Bengal.

The Director of Agriculture, United Provinces.

The Director of Agriculture, Bihar and Orissa.

Dr. F. J. F. Shaw, Director, Imperial Institute of Agricultural Research.

Rao Bahadur B. Viswanath, Imperial Agricultural Chemist.

Professor P. K. Parija, Ravenshaw College, Cuttack.

Professor S. P. Agharkar, University of Calcutta.

Mr. K. Ramiah, Paddy Specialist, Madras.

Mr. M. Vaidyanathan, Statistician, Imperial Council of Agricultural Research.

Secretary, Imperial Council of Agricultural Research, Secretary, *ex-officio*.

The Committee will meet at 2-45 p.m. on Wednesday the 20th February, 1935, and consider the undermentioned items of the agenda of the present meeting of the Advisory Board:—

Annual report on the working of the rice research scheme in Bengal for the year 1933-34.

Annual report on the working of the rice research scheme in Burma for the year 1933-34.

Annual reports on the working of the rice research schemes in Madras and United Provinces for the year 1933-34 and in the Central Provinces for the period September 1932—March 1934 (reports already circulated to the Advisory Board with this Department Memorandum No. F.229/34-A., dated 8th November 1934).

Annual report on the working of the rice research scheme in Bihar and Orissa for the year 1933-34.

2. *Sunn-hemp Sub-Committee.*—

In accordance with the practice followed in the past, the Vice-Chairman to the Council has, subject to the Advisory Board's approval appointed the undermentioned committee to examine the sunn-hemp schemes on the agenda:—

The Vice-Chairman, Imperial Council of Agricultural Research, Chairman, *ex-officio*.

The Agricultural Expert, Imperial Council of Agricultural Research.

The Director of Agriculture, Madras.

The Director of Agriculture, Bombay.

The Director of Agriculture, Bengal.

The Director of Agriculture, United Provinces.

The Director of Agriculture, Bihar and Orissa.

The Director of Agriculture, Central Provinces.

Secretary, Imperial Council of Agricultural Research, Secretary, *ex-officio*.

The Committee will meet at 2.45 p.m. on Monday the 18th February 1935.

Application from the Government of Bombay for a grant of Rs. 6,000 spread over two years for a scheme of investigations of the problems of sunn hemp cultivation.

Scheme of research on sunn-hemp manufactures in Bombay.

### 3. Fruit Sub-Committee.

Application from the Government of Bombay for a grant of Rs. 78,650 spread over a period of five years for a scheme for the improvement of papaya breeding and cultural practices.

In accordance with the usual practice, the Committee of the Advisory Board consisting of the members named below, will examine the fruit scheme mentioned above:—

The Vice-Chairman, Imperial Council of Agricultural Research, Chairman *ex-officio*.

The Agricultural Expert, Imperial Council of Agricultural Research.

The Director of Agriculture, Madras.

The Director of Agriculture, Bombay.

The Director of Agriculture, Bengal.

The Director of Agriculture, United Provinces.

The Director of Agriculture, Bihar and Orissa.

The Director of Agriculture, Punjab.

The Director of Agriculture, Central Provinces.

The Director of Agriculture, Assam.

The Director of Agriculture, Hyderabad.

The Director of Agriculture, Mysore.

The Director of Agriculture, Baroda.

The Agricultural Officer, North-West Frontier Province.

The Agricultural Officer, Baluchistan.

The Chief Publicity Officer, Indian State Railways.

Secretary, Imperial Council of Agricultural Research, Secretary, *ex-officio*.

The Committee will meet at 3.30 p.m. on Monday the 18th February, 1935.

4. *Plant Diseases Sub-Committee*.—The Vice-Chairman to the Council considers that it will be an advantage to have the undermentioned three schemes relating to the diseases of plants, examined in the first instance by a Committee and he has accordingly appointed, subject to the approval of the Board, the undermentioned Committee:—

The Vice-Chairman, Imperial Council of Agricultural Research, Chairman *ex-officio*.

The Agricultural Expert, Imperial Council of Agricultural Research.

The Director of Agriculture, Bombay.

The Director of Agriculture, Central Provinces.

The Imperial Mycologist, Imperial Institute of Agricultural Research, (subject to the approval of the Government of India).

Professor T. Ekambaram.

Dr. K. C. Mehta (subject to the approval of the Principal, Agra College).

Secretary, Imperial Council of Agricultural Research, Secretary, *ex-officio*.

The Committee will meet at 3.30 p.m. on Wednesday the 20th February 1935.

Application from the Government of the Central Provinces for a grant of Rs. 35,500 spread over a period of five years for a scheme of research work on pan cultivation.

Application from the Government of Bombay for a grant of Rs. 49,360 spread over five years for a scheme for investigation into the attack on jowar by the parasite 'striga'.

Application from the Government of Bombay for a grant of Rs. 37,510 spread over five years for a scheme for the investigation of the attack on tobacco by the Phanerogamic Parasite 'Orobanches'.

5. *Potato Sub-Committee*.—The Vice-Chairman to the Council has, subject to the Board's approval appointed the undermentioned Committee to discuss the technical details of the potato scheme sanctioned by the Governing Body at its meeting held in January, 1935.

The Vice-Chairman, Imperial Council of Agricultural Research, Chairman, *ex-officio*.

The Agricultural Expert, Imperial Council of Agricultural Research.

The Director of Agriculture, Madras.

The Director of Agriculture, Bombay.

The Director of Agriculture, Bengal.

The Director of Agriculture, United Provinces.

The Director of Agriculture, Punjab.

The Director of Agriculture, Bihar and Orissa.

The Director of Agriculture, Central Provinces.

The Director of Agriculture, Assam.

The Director, Imperial Institute of Agricultural Research, Pusa.

Dr. B. P. Pal, Second Imperial Economic Botanist, Imperial Institute of Agricultural Research, Pusa.

Professor P. K. Parija, Ravenshaw College, Cuttack.

Secretary, Imperial Council of Agricultural Research, Secretary, *ex-officio*.

The Committee will meet at 2-30 p.m. on Wednesday the 20th February 1935.

6. *Agricultural Meteorology Sub-Committee*.—The Vice-Chairman to the Council considers that it will be an advantage to have the undermentioned Agricultural Meteorology Scheme and progress report on the same subject which are included in the agenda examined in the first instance by the Committee consisting of the following members:—

The Vice-Chairman, Imperial Council of Agricultural Research, Chairman, *ex-officio*.

The Agricultural Expert, Imperial Council of Agricultural Research.

All Directors of Agriculture present.

The Director, Imperial Institute of Agricultural Research, Pusa.

The Imperial Agricultural Chemist (if in Delhi).

The Director, Indian Institute of Science.

Professor T. Ekambaram.

Dr. L. A. Ramdas, Agricultural Meteorologist, Poona.

Chief Agricultural Officer, Sind.

Secretary, Imperial Council of Agricultural Research, Secretary, *ex-officio*.

The Committee will meet at 2-45 p.m. on Thursday the 21st February, 1935.

Annual report on the working of the Agricultural Meteorology Branch, Poona, for the second year ending 21st August 1934.

Application from the Director General of Observatories, Poona, for a grant of Rs. 1,39,000 spread over five years for a revision and extension of the present scheme of agricultural meteorology already sanctioned by the Imperial Council of Agricultural Research.

7. *All-India Fertilisers Act Sub-Committee*.—The Vice-Chairman to the Council considers that it will be an advantage to have the undermentioned proposal examined in the first instance by a Committee and he has accordingly appointed subject to the approval of the Board the following Committee:—

The Vice-Chairman, Imperial Council of Agricultural Research, Chairman, *ex-officio*.

The Agricultural Expert, Imperial Council of Agricultural Research.

The Director of Agriculture, Madras.

The Director of Agriculture, Bengal.

The Chief Agricultural Officer, Sind.

The Agricultural Chemist, Bombay.

- The Agricultural Chemist, Punjab.  
 The Agricultural Chemist, Bihar and Orissa.  
 The Agricultural Chemist, Burma.  
 The Agricultural Chemist, Central Provinces.  
 Dr. S. B. Singh, Deputy Director of Agriculture, United Provinces.  
 Rao Bahadur B. Viswanath, Imperial Agricultural Chemist, Imperial Institute of Agricultural Research, Pusa.  
 Mr. P. H. Carpenter.  
 Dr. J. N. Mukherjee, Calcutta University.

Secretary, Imperial Council of Agricultural Research, Secretary, *ex-officio*.

The Committee will meet at 2-30 P.M. on Saturday, the 23rd February 1935.

Proposal for an All-India Fertilisers Act (Committee only).

8. *Standing Cattle Breeding Committee*.—The Vice-Chairman to the Council considers that it will be an advantage to have the following schemes on the agenda to be considered by the Cattle Breeding Committee which consists of the following members:—

- The Vice-Chairman, Imperial Council of Agricultural Research, Chairman, *ex-officio*.  
 The Animal Husbandry Expert, Imperial Council of Agricultural Research.  
 Mr. T. F. Quirke, Director of Veterinary Services, Punjab.  
 Major C. E. McGuckin, Assistant Director, Military Dairy Farms.  
 Mr. E. J. Bruen, Livestock Expert to Government, Bombay.  
 Chaudhari Dost Mohammad Khan, Proprietor, Jehangirabad Cattle Farm.  
 Mr. C. H. Parr, Deputy Director of Agriculture, United Provinces.  
 Secretary, Imperial Council of Agricultural Research, *ex-officio* Secretary.

The Committee will meet at 2-30 p.m. on Monday the 18th February 1935.

Application from the Government of Bombay for a grant of Rs. 1,22,130 spread over a period of ten years for research in goat breeding in the Bombay Presidency.

Application from the Government of Bombay for a scheme of research in poultry husbandry to be conducted in the Bombay Presidency at a cost not exceeding Rs. 61,053; (Rs. 22,023 non-recurring and Rs. 39,030 recurring) spread over a period of five years.

Application from Mr. J. J. DeValois of the Agriculture Institute, Katpadi, for a scheme of research on goat breeding at a cost not exceeding Rs. 84,172 (Rs. 5,480 non-recurring and Rs. 78,692 recurring) spread over a period of ten years.

Enquiry from the Director, Economic Entomology of the Council for Scientific and Industrial Research for the appointment of an Entomologist in India at their cost to study of the natural control of blowflies and of the buffalo-fly.

Application from the United Provinces Poultry Association for a grant for research into the preservation and handling of eggs and poultry prior to their disposal in the market at a cost not exceeding Rs. 32,570, (Rs. 5,784 non-recurring and Rs. 26,786 recurring) spread over a period of three years.

9. *Standing Animal Nutrition Committee*.—The Vice-Chairman to the Council considers that it will be an advantage to have the two schemes noted below, among other things, to be considered by the Cattle Breeding Committee which consists of the following members:—

- The Vice-Chairman, Imperial Council of Agricultural Research, Chairman, *ex-officio*.  
 The Animal Husbandry Expert, Imperial Council of Agricultural Research.  
 Dr. F. J. Warth, Physiological Chemist, Bangalore.  
 Dr. P. E. Lander, Agricultural Chemist, Lyallpur.  
 Dr. K. C. Sen, Biochemist, Imperial Institute of Veterinary Research, Muktesar.

Rao Bahadur B, Viswanath, Imperial Agricultural Chemist.

Mr. J. R. Haddow, Veterinary Research Officer in charge of Serology, Imperial Institute of Veterinary Research, Muktesar.

Secretary, Imperial Council of Agricultural Research, Secretary, *ex-officio*.

The Committee will meet at 2-30 p.m. on Wednesday the 20th February, 1935.

Reference from the Public Health Commissioner to the Government of India, regarding a proposal from Major General Sir McCarrison, Director, Nutrition Research, Indian Research Fund Association, for a survey of food material and their food values throughout India.

Application from the United Provinces Government for a grant of Rs. 1,96,720 (Rs. 19,000 non-recurring and Rs. 1,77,720 recurring) spread over a period of five years for a scheme of practical research into the feeding of cattle at the departmental farms.

The Vice-Chairman considers that the following schemes on the agenda on bee-keeping should first be examined by a sub-committee of the Board, the personnel of the Committee to be settled at the meeting of the Board. The Committee will meet on Monday, the 18th February 1935 at 2-30 p.m.

13. Application from the Government of Bombay for a grant of Rs. 29,070 spread over three years for a scheme of research in epiculture by Mr. C. J. George, Professor of Botany, Willson College, Bombay.

14. Application from the Government of Baroda for a grant of Rs. 16,900 (five years) for a scheme of research on bee-keeping in Gujerat.

A plan is attached (Enclosure) showing the date, time and place of the meetings of the various Committees. The exact places of the meetings will be announced at the full meeting of the Board on each day.

#### ENCLOSURE TO APPENDIX II.

STATEMENT SHOWING THE TIME AND PLACE OF THE MEETINGS OF THE VARIOUS COMMITTEES WHICH WILL MEET IN CONNECTION WITH THE ADVISORY BOARD FROM THE 18TH TO THE 23RD FEBRUARY 1935.

	<i>Agriculture.</i>	<i>Animal Husbandry.</i>
Monday, the 18th February 1935.	Sunn Hemp Committee 2-45 P.M. Fruit Sub-Committee 3-30 P.M.	Bee-keeping Sub-Committee 2 P.M. Standing Cattle Breeding Committee 2-30 P.M.
Tuesday, the 19th February 1935.	....	....
Wednesday, the 20th February 1935.	Potato Committee 2-30 P.M. Rice Sub-Committee 2-45 P.M. Plant Disease Sub-Committee 3-30 P.M.	Standing Animal Nutrition Committee 2-30 P.M.
Thursday, the 21st February 1935.	Agricultural Meteorology Scheme 2-45 P.M.	Standing Dairying Committee 2-30 P.M.
Friday, the 22nd February 1935.	....	Dairy Legislation Committee 2-30 P.M.
Saturday, the 23rd February 1935.	All-India Fertilisers Committee 2-30 P.M.	Dairy Legislation Committee (to be continued if necessary) 2-30 P.M.

## APPENDIX III.

NOTE, DATED THE 29TH JANUARY 1935, BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH ON SUBJECT NO. 3.—REPORT OF THE COCONUT COMMITTEE APPOINTED TO CONSIDER THE REPORT ON COCONUT ENQUIRY IN INDIA, BY DR. J. S. PATEL.

At its last meeting held in September 1934 the Advisory Board discussed the report (not printed) on Coconut Enquiry in India prepared by the Special Officer appointed by the Council and considered *inter alia* the question of tariff on Ceylon-Coconut products. In view of the importance of the question the Board decided to appoint a small sub-Committee to discuss the details of the problem in all its bearings and to make a considered recommendation. It was further agreed that the Board should empower the sub-Committee to submit their report to the Government of India in order to avoid delay, subject to further action by the Board at its next meeting.

2. The Vice-Chairman to the Council accordingly formed a sub-Committee consisting of the following :—

1. Vice-Chairman, Imperial Council of Agricultural Research—Chairman.
2. Agricultural Expert, Imperial Council of Agricultural Research.
3. Agricultural Marketing Adviser to the Government of India.
4. Director of Agriculture, Madras.
5. Director of Agriculture, Travancore.
6. Dewan Peshkar of Cochin.
7. Director of Industries, Mysore.
8. Mr. S. D. Saklatvala of Messrs. Tata & Sons, Limited, Bombay.
9. Mr. J. H. Walker, Manager of Gourepore Oil Mills, Calcutta.
10. A representative of the Karachi Oil Crushers and Manufacturers of Vegetable Products.
11. A representative of the Bombay Oil-crushers and Manufacturers of Vegetable Products.
12. Mr. R. M. Gandhi, President of the Sped Traders' Association, Bombay.
13. A Bengal importer of coconuts, copra and coconut oil.
14. A representative of the Government of Burma.
15. Mr. N. G. Hayden, President of the Travancore Chamber of Commerce.

(Nos. 8, 9, 11 and 13 could not attend the meeting).

3. The Committee met at New Delhi on 14th-16th January 1935 and prepared the attached report (enclosure) a copy of which has been submitted to the Government of India, Commerce Department, as recommended by the Board.

4. The report is now for further consideration by the Advisory Board.

## ENCLOSURE TO APPENDIX III.

REPORT OF THE COCONUT COMMITTEE HELD AT NEW DELHI ON JANUARY 14-16, 1935.

*Present.*

1. Diwan Bahadur Sir T. Vijayaraghavacharya, *Vice-Chairman*, Imperial Council of Agricultural Research, *Chairman*.
2. Mr. B. C. Burt, Agricultural Expert, Imperial Council of Agricultural Research.
3. Mr. A. M. Livingstone, Agricultural Marketing Adviser to the Government of India.
4. Mr. S. V. Ramamurthy, Director of Agriculture, Madras.
5. Mr. K. Parameswaran Pillai, Director of Agriculture, Travancore, Trivandrum.
6. Mr. K. Achyutha Menon, Diwan Peshkar of Cochin, Ernakulam.
7. Mr. A. V. Ramanathan, Director of Industries, Mysore, Bangalore.
8. Mr. B. K. Gangaramani, of Messrs. Lunidaram Palilumal, D., & Co., Bunder-Road, Karachi.



9. Mr. R. M. Gandhi, President of the Seed Traders' Association, Jenabai Buildings, Bunder Road, Bombay.
10. Mr. J. H. Wise, I.C.S., Representative of the Government of Burma.
11. Mr. N. G. Hayden, President of the Travancore Chamber of Commerce, Alleppy.

The Committee considered the following documents :—

The report presented by Dr. Patel on the coconut enquiry in India; the comments on this report by the Advisory Board of the Council; the memorial and note submitted by the Coconut Growers' Association, Narakal; a memorandum by the Travancore Chamber of Commerce; a note by one of its members (Mr. S. D. Saklatvala), who was unable to attend; and a memorandum from the Buyers and Shippers Chamber, Karachi. It also had before it a statement of recent prices for coconut products prepared by the statistical section of the Imperial Council of Agricultural Research and other statistical information. The representative from Burma desires it to be clear that his instructions do not authorise him to commit the Government of Burma to any of the conclusions of the Committee.

2. After very careful consideration the Committee is agreed that steps should be taken to raise the price of coconuts, *copra* and coconut oil and other coconut products in India to a level more in accordance with the cost of production. The statistics published by the League of Nations show that by January 1934, world prices of coconut oil had fallen far more than the prices of other agricultural products. There has also been a marked fall in the prices of coconut oil and *copra* in India since January 1933 and coconut oil which is normally somewhat more expensive than groundnut oil is now appreciably cheaper whilst it is very much cheaper than gingelly oil and has been increasingly so since 1931. That coconut oil and *copra* are now disproportionately cheap compared to other agricultural produce in India will be clear from the price quotations and index figures attached.

3. Those members of the Committee who have personal knowledge of South India conditions impressed on us the extent of the hardship which has been caused in those areas, viz., Malabar, Travancore and Cochin which are dependent on coconuts. There are large imports of coconut oil and *copra* from Ceylon and such imports have increased, rather than decreased, since Dr. Patel's report was made; this will be clear from the progressive totals for the period April to November 1934, as compared to the corresponding period for 1933 and 1932, shown in Annexure I. There is reason to believe that both coconut oil and *copra* are being exported from Ceylon at distress prices. Coconut companies in Ceylon are paying no dividends and the list of share quotations in annexure II shows that their shares are almost a drug on the market. In the same annexure will be found an extract from "Statement of Objects and Reasons" for the Ceylon Coconut Products Ordinance, 1934, which emphasises the same point.

4. Using the figures contained in Dr. Patel's report, we have prepared what appears to us to be a fair estimate of the cost of production of *copra* in South India. Details of this are given in Annexure III and it is sufficient to say here that taking the cost of establishing a coconut garden at Rs. 580 per acre, allowing 10 years for it to come into full bearing and a life of 50 to 60 years, the cost of producing a ton of *copra*, if the coconut garden owner is allowed 6 per cent. on his investment, amounts to Rs. 219 per ton. The tariff valuation in January 1935 for imported *copra* is Rs. 120 per ton—or say Rs. 135 after allowing for landing charges, etc., at either Alleppy or Cochin. This leaves a gap of Rs. 84 per ton between the cost of producing Indian *copra* and the price of imported *copra*.

If the lower figure (Rs. 200 per acre) instead of the average figure (Rs. 250 per acre) for the cost of suitable land mentioned in Dr. Patel's report be adopted, the cost of establishing an acre of garden would be reduced by Rs. 50 and the cost per ton of *copra* by Rs. 13 to Rs. 206. The difference between Indian *copra* and imported *copra* would then be Rs. 71 per ton.

5. Whilst the *ad valorem* rates of duty on *copra* and coconut oil have been raised since 1929, the actual duty charged has fallen heavily due to the fall in c.i.f. prices of the imported product. The actual duty on a ton of *copra* in April 1929 was Rs. 69 although the *ad valorem* rate of duty was only 15 per cent. At that time coconut growers were not making large profits but there was no actual distress and we consider that if the 1929 position could be restored, so far as the import duty is concerned, the coconut industry in South India would have a chance of recovery. In the light of our calculation of the cost of production we consider that the actual duty on *copra*

should be Rs. 70 per ton at least, and the same duty should apply to "desiccated coconut". We feel confident that an enquiry by the Tariff Board would confirm our conclusions in this respect.

6. With the present abnormalities in the world prices for agricultural produce, *ad valorem* duties alone are unlikely to give a sufficient measure of protection to producers of agricultural commodities and there are also weighty objections on principle to very high *ad valorem* rates of duty; there are also objections to rigidly fixed specific rates of duty. We therefore suggest that *copra* should continue to be liable to a relatively low *ad valorem* rate of duty but that it should be subject to a minimum specific duty of Rs. 70 per ton which is the equivalent of 15 per cent. *ad valorem* at 1929 prices.

7. The relationship of the duty on coconut oil to that on *copra* is a matter of great importance. At present the *ad valorem* rate of duty on coconut oil is 25 per cent. as compared to 20 per cent. on *copra* but owing to changes in tariff valuations following changes in world prices, the relationship between duties on *copra* and coconut has fluctuated sufficiently to be a disturbing factor in the *copra*-crushing industry. It is important that the actual duty on coconut oil should be so calculated that the duty paid on 12 cwt. of oil is identical with that on a ton of *copra* from which it can be produced; this follows from the fact that the average extraction of oil from Ceylon *copra* is 60 per cent. On theoretical grounds it may be argued that a deduction should be made from the actual duty on coconut oil to allow for the fact that imported coconut cake is liable to a duty of 25 per cent. *ad valorem*. In actual fact there are no such imports and the disposal of coconut cake is not always an easy matter for oil-crushers. Moreover, as shown in Dr. Patel's report the oil-crushing industry might reasonably advance a claim for a small differential in their favour since shipping freight and charges on Ceylon *copra* are somewhat higher than on imported coconut oil. All things considered, we suggest that these two items more or less balance but we accept the view of the representatives of the milling industry that there should be an additional duty of Rs. 3 per ton on coconut oil to compensate for the higher freight on coconut oil from west coast ports to Calcutta as compared to freights on the same commodity from Colombo. Hence the minimum specific duty on coconut oil should be Rs. 120 per ton.

8. The minimum specific duty on imported coconuts should be similarly adjusted so as to be proportionate to that on *copra*. As 4,800 Ceylon coconuts yield one ton of *copra* on an average this would be approximately Rs. 15 per 1,000.

9. If minimum specific duties at the above level are introduced, there would be no objection to the reduction of the *ad valorem* rate of duty on Ceylon and other Empire *copra* and coconut oil and coconuts to 15 per cent. *ad valorem*, since the minimum necessary protection to the local coconut growing industry would be provided by the minimum specific duty.

10. A reference is made in the report to the export duty on coconuts, *copra* and coconut oil from the Travancore State and to the differential in the export duty between *copra* and coconut oil which in effect is a bounty to Travancore oil-crushers at the expense of the coconut grower. The export duty itself has been in existence for a number of years and is connected with the system of revenue assessment in the Travancore State and we have been informed that the total tax on coconut growing in Travancore is not excessive. Nevertheless, in view of the fact that we are recommending the introduction of a protective import duty on coconuts and coconut products, we venture to suggest that the Travancore Government might well consider whether its revenue position would permit the removal of the export duty on coconuts and coconut products in order that their agriculturists may receive the full benefit of the measures which we are recommending. As Dr. Patel's report shows the Ceylon Government has recently abolished export duties on both coconuts and coconut products. In any event, we would urge the Travancore Government to consider the removal of the differential duty on *copra*. If the retention of an export duty is unavoidable, we suggest that it should be so calculated that the export duty on one ton of *copra* would be identical with that on 12 cwt. of coconut oil.

11. We have considered the question as to whether a rise in the price of coconut oil would lead to the substitution of other vegetable oils for coconut. It seems not unlikely that the immediate effect would be to encourage the substitution of groundnut oil made in India for at least a proportion of the imported coconut oil; this would probably only be reversing the process which has been taking place during the last two or three years when coconut oil has been disproportionately cheap. So far as we can judge the increase in duty which we have proposed, if fully effective, would raise the price of coconut oil by about eleven annas per Bombay maund of 28 lbs. above

that of groundnut oil. We observe that this difference has been as high as Re. 1 in favour of coconut oil in the past and that a difference of eight annas is not uncommon.

12. We would also draw attention to the various recommendations made in the report for the improvement of the efficiency of coconut production and the marketing of coconuts and coconut products. If the coconut industry in India is granted protection for a reasonable term of years, we consider that during that period a sustained effort should be made to establish an efficient industry which can hold its own without special assistance. We desire however to state our view that some form of protection is an indispensable preliminary to progress. Unless coconut growers receive some relief, and that very quickly, rapid deterioration is inevitable. We are informed by the South India representatives that the manuring of coconut palms has been discontinued; that the cultivation in the gardens is being neglected and that even the maintenance of the bunds, which are necessary to prevent these low lying tracts from reverting to swamp, is now being neglected. Unless the price of coconut products can be improved, much of the capital invested in coconut gardens may permanently be lost and a permanent contraction take place in the *copra*-producing capacity of South India.

(Sd.) T. VIJAYARAGHAVACHARYA.

(Sd.) B. C. BURT.

(Sd.) A. M. LIVINGSTONE.

(Sd.) J. H. WISE.

(Sd.) RATILAL M. GANDHI.

(Sd.) B. K. GANGARAMANI.

(Sd.) N. G. HAYDEN.

(Sd.) K. ACHYUTHA MENON.

(Sd.) K. P. PILLAI.

(Sd.) A. V. RAMANATHAN.

(Sd.) S. V. RAMAMURTHY.

NEW DELHI;  
The 16th January, 1935.

#### ANNEXURE I.

*Imports of Coconut Oil and Copra into India for the period April to November  
(8 months).*

	1934.	1933.	1932.
Coconut oil (thousand gallons) . . . . .	6,118	4,418	5,495
Copra (tons) . . . . .	23 525	21,343	13,573

## ANNEXURE II.

*Times of Ceylon complete list of about December 15th.*

## SHARE LIST.

## A.—Ceylon and Indian Produce Companies.

Rupee Coconut Companies.	Amount paid per share.	Buyers.	Sellers.	Transaction.
(Ceylon and Straits).				
Arcadia C'nut Estates . . . . .	10	..	5½	..
Ceylon Coconut Company . . . . .	100	..	..	..
Coconut Estates of Perak . . . . .	2½	..	1½	..
Dandegama Coconut Co. . . . .	10	..	2	..
H. Bastian Fernando Estates Co., Ltd. . . . .	100	..	..	..
Henavasel Coconut Estates . . . . .	10	..	..	..
Horrekelly Estates . . . . .	100	42	..	..
Kirivaula Coconut . . . . .	20	..	..	..
Lower Perak Coconut . . . . .	10	4	..	..
Martin Coconut Estates . . . . .	50	8	9	..
Mola Eliya Coconut . . . . .	9½	..	..	..
Perak Congai Coconut . . . . .	10	..	..	..
Perak River Coconut . . . . .	10	3	..	..
Sir H. Dias Coconut . . . . .	100	15	20	..
Telok Bharu Coconut . . . . .	10	..	5½	..

B.—Extract from the "Statement of Objects and Reasons" for the "Ceylon Coconut Products Ordinance 1934."

(*Ceylon Government Gazette*, 26th October 1934.)

## OBJECTS AND REASONS.

The object of this Bill is to make provision for the relief of the coconut industry and for the marketing and exportation of the products of the coconut palm. The world-wide decline in the prices of copra, coconut oil and other coconut products has made it imperative that action should be taken immediately for the rescue of the industry from its present hazardous position, and this Bill accordingly seeks to give legislative effect to a variety of measures calculated to alleviate and improve the depressed condition of the market in coconut products.

\* \* \* \*

7. The cess referred to in Clause 23 will be used to defray the expenses of the Board and particularly to enable the Board to carry on propaganda with a view to increasing the demand for Ceylon coconut products in the markets of the world. It is not intended that all the activities of the Board should be financed from the cess alone. Provision has accordingly been made for the Board to receive, disburse and administer such monies as the State Council may vote or provide in aid of an industry which is the mainstay of the indigenous population of the Island.

\* \* \* \*

## ANNEXURE III.

*Cost of Production of Copra.*

Basis :—

*Initial Outlay—*

Basis :—

*Initial Outlay—*

	Rs.
Average cost of an acre of suitable land . . . . .	250
Incidental charges . . . . .	50
Total cost of land per acre . . . . .	300
Interest at 3 per cent. on Rs. 300 during development per acre . . . . .	90
Average cost of planting and cultivation up to 10th year (i.s. prior to bearing) per acre . . . . .	190
Total initial outlay per acre . . . . .	580

Annual cost of maintenance per acre (Travancore) . . . . . 25

Average yield per acre (Travancore) = 1,750 nuts equivalent at 6,250 nuts per ton of *copra* to approximate 3/10ths ton *copra* per acre

*Depreciation.*—Average life of a garden 50—60 years—allow depreciation at 2 per cent on Rs. 280 only.

*Bye-products.*—Selected husks are worth Rs. 5 per thousand but as many are un-useable a recovery of Rs. 5 per acre is a fair average.

*Cost of production per ton of copra—*

	Per ton. Rs. A.
Garden maintenance (Rs. 25 × 10) . . . . .	83 5
Cost of <i>copra</i> manufacture average) . . . . .	7 8
Cost of packing and marketing . . . . .	10 0
Depreciation at 2 per cent on Rs. 280 per acre (5·6 × 10) . . . . .	18 10
Profit at 6 per cent. on investment (Rs. 580 per acre) Rs. 34·8 per acre: per ton . . . . .	116 0
	235 7
<i>Deduct</i> —Value of husks at Rs. 5 per acre: per ton Rs. 16 . . . . .	16 0
Cost per ton of <i>copra</i> . . . . .	219 7

*Imported Copra—*

C. I. F. cost of imported <i>copra</i> (Tariff valuation 1935) . . . . .	120
Landing and delivery charges to meet mills at Alleppy or Cochin (average) . . . . .	15
	135

## ANNEXURE IV.

*Index figures for prices of Coconut Oil and other agricultural produce.*

I. League of Nations Index figures \*for Gold prices in important markets in producing countries (1914 Basis=100)

	January 1933.	January 1934.
Price of Wheat . . . . .	42	32
„ Cotton . . . . .	34	38
„ Rice . . . . .	41	31
„ Coconut Oil . . . . .	41	28
„ Linseed Oil . . . . .	45	46

\*Taken from the League of Nations World Economic Survey 1933-34 "Wholesale price movements of certain Food Stuffs and Raw Materials (pp. 141,142)-

## II. Mysore State—Basis 1914=100.

	*July 1933.	March 1934.	November- 1934.
General Price Index . . . . .	98	96	104
Price of Groundnuts . . . . .	81	..	..
"  Til . . . . .	71	..	..
"  Ragi . . . . .	76	..	..
"  Rice . . . . .	71	..	..
"  Coconut Oil . . . . .	49	39	38

## III.—Indian Price Index Numbers for Coconut Oil and other Agricultural Products and other Commodities.

(July 1914=100).

Calcutta (Indian Trade Journal).

Period.	Cereals.	Pulses.	Mustard Oil.	Cotton Oil.	All com- modities.	Cochin Coconut Oil.
1930.						
January . . . . .	111	144	105	112	131	76
February . . . . .	104	132	100	101	126	75
March . . . . .	103	140	99	107	125	72
April . . . . .	103	129	105	105	123	72
May . . . . .	104	120	99	105	121	70
June . . . . .	103	116	97	87	166	70
July . . . . .	101	117	99	87	115	65
August . . . . .	106	110	95	83	114	64
September . . . . .	96	111	95	80	111	66
October . . . . .	95	105	95	78	107	65
November . . . . .	87	103	90	76	103	65
December . . . . .	84	96	85	69	100	60
1931.						
January . . . . .	83	83	73	80	98	57
February . . . . .	82	81	75	94	99	56
March . . . . .	85	82	70	93	100	59
April . . . . .	79	84	70	83	98	59
May . . . . .	78	82	70	83	97	52
June . . . . .	74	81	65	87	93	50
July . . . . .	76	92	65	79	93	51
August . . . . .	76	96	65	71	92	51
September . . . . .	73	91	65	74	91	52
October . . . . .	77	91	64	79	96	59
November . . . . .	76	96	65	82	97	62
December . . . . .	78	108	65	97	98	71

\* Review of the Foreign Rail borne trade of the Mysore State 1932-33.

## Calcutta (Indian Trade Journal).

Period.	Cereals.	Pulses.	Mustard Oil.	Cotton Raw.	All com- modities.	Cochin- Coconut Oil.
1932.						
January . . . . .	76	106	65	103	97	71
February . . . . .	72	95	65	106	97	74
March . . . . .	70	86	61	89	94	72
April . . . . .	66	83	61	89	92	64
May . . . . .	66	87	57	81	89	63
June . . . . .	65	89	55	76	86	64
July . . . . .	67	90	59	86	87	64
August . . . . .	69	93	65	105	91	66
September . . . . .	68	93	61	95	91	68
October . . . . .	69	95	61	87	91	68
November . . . . .	67	95	61	94	90	66
December . . . . .	64	92	62	89	88	62
1933.						
January . . . . .	66	87	62	87	88	58
February . . . . .	66	88	61	79	86	52
March . . . . .	61	81	53	79	82	49
April . . . . .	58	81	51	80	84	49
May . . . . .	66	88	53	84	87	49
June . . . . .	69	85	51	87	89	50
July . . . . .	70	85	51	89	91	47
August . . . . .	66	84	51	79	89	44
September . . . . .	68	83	48	82	88	43
October . . . . .	67	81	48	74	88	41
November . . . . .	70	82	48	72	88	41
December . . . . .	70	79	48	68	89	39
1934.						
January . . . . .	61	78	48	75	90	38
February . . . . .	63	84	50	73	89	36
March . . . . .	62	84	46	72	88	34
April . . . . .	66	89	51	68	89	33
May . . . . .	68	85	56	71	90	34
June . . . . .	71	86	58	73	90	34
July . . . . .	71	83	55	73	89	34
August . . . . .	77	86	55	74	89	35
September . . . . .	74	84	53	72	89	38
October . . . . .	73	85	53	74	89	39
November . . . . .	71	83	55	76	88	37
December . . . . .	73	87	61	80	88	38

## For Coconut Oil Notes :

- (1) Prices are taken from Indian Trade Journal and Dr. Patel's report, pp. 84-85
- (2) Price of Coconut Oil in July 1914 was Rs. 163 per candy of 654 lbs. at Cochin.
- (3) During the pre-war quinquennium, the average price of Coconut Oil at Alleppy was 150 to 160 Rupees per candy of 654 lbs., corresponding to Rs. 153 to Rs. 163 at Cochin.

## APPENDIX IV.

NOTE, DATED THE 26TH JANUARY 1935, BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT NO. II.—REPORT ON (i) THE LABORATORY FOR COLLECTING, BREEDING AND DESPATCHING BENEFICIAL PARASITES AT FARNHAM HOUSE FOR THE YEAR ENDING 31ST MARCH 1934, AND (ii) THE INVESTIGATIONS INTO THE CONTROL OF INSECTS AND MOULDS INJURIOUS TO STORED PRODUCTS AT SLOUGH FOR THE PERIOD 30TH SEPTEMBER 1933 TO 1ST OCTOBER 1934.

At its meeting held in February 1934, the Advisory Board recommended a proposal for a contribution by India of a sum of Rs. 14,500 during the period 1st October 1933 to the 1st March 1935, towards (i) the maintenance of the laboratory for collecting, breeding and despatching beneficial parasites at Farnham House, Farnham Royal and (ii) the investigations into the control of insects and moulds injurious to stored products at Slough (*vide* printed proceedings of the meetings of the Board pages 27-28 and 286-304). The proposal was sanctioned by the Governing Body in circulation.

2. The reports on the working of (i) the laboratory at Slough for the year ending 31st March (Enclosure I) and (ii) the investigations at Slough for the period 30th September, 1933 to 1st October 1934 (Enclosure II), which have now been received from the High Commissioner for India, are for consideration and any technical comments which members of the Board may wish to offer.

## ENCLOSURE I.

REPORT ON THE WORK OF THE FARNHAM HOUSE LABORATORY, FOR THE YEAR ENDING 31ST MARCH, 1934.

(1st April, 1933 to 31st March, 1934.)

Owing to the fact that no final decision was taken at the Ottawa Conference of 1932 concerning the future of the Empire Marketing Board, from which the Laboratory obtained the greater part of its revenue, the financial year 1933-34 opened in an atmosphere of uncertainty and financial restriction. The position was not materially improved by the publication of the report of the Imperial Committee on Economic Consultation and co-operation, which merely recommended that the Executive Council of Imperial Agricultural Bureaux should be entrusted with the supervision of such research activities in the United Kingdom as the participating Governments may agree should in future be conducted on a 'co-operative basis' (Cmd. 4335, p. 91, par. 358 (a)-(i) (C).) without selecting, for co-operative support, any of the schemes hitherto financed by the Empire Marketing Board. The Empire Marketing Board itself came to an end on 30th September, 1933, before any arrangements had been made for the co-operative support of the Laboratory, so that it became necessary to give the members of the staff three months' notice of termination of appointment, as from the date mentioned. Even by the end of the financial year, the position of the Laboratory had not been definitely settled.

In spite of the serious disadvantages under which it laboured during this period, the work of the Laboratory continued more actively than even before. Ninety-five shipments of beneficial insects, comprising a total of about 1,219,738 specimens, were despatched to various parts of the Empire.

Country.	No. of Shipments.	No. of Specimens Shipped.
Canada . . . . .	40	720,149
Australia . . . . .	25	56,702
New Zealand . . . . .	4	427,050
Great Britain . . . . .	24	12,857
Foreign States . . . . .	2	3,000

This maintenance of its activity was partly due to funds, to the amount of £1,632 5s. 8d. provided by the Entomological Branch of the Canadian Department



of Agriculture, for work on several insects of special interest to Canada, and £305. subscribed by the New Zealand Government and the farmers of the Hawkes Bay Districts of New Zealand, for the collection of parasites of the Cabbage White Butterfly; but it was also due to the fact that during the six years that had elapsed since its foundation, the standard of work at the Laboratory had steadily improved owing to the steady increase of experience of the permanent staff and the temporary workers employed from the village of Farnham Royal. As a result of their experience and training in our special field of work, the staff has now developed into an efficient and harmonious organisation, able to tackle the most difficult practical problems at short notice, with great rapidity and a minimum of expenditure.

The main projects taken up by the Laboratory during the financial year 1933-34 have been as follows:—

#### *Insects Affecting Cereal and Forage Crops.*

*Western Wheat-stem Sawfly (Cephus cinctus, Norton).*—This insect is a native of North America, and formerly only attacked wild grasses, and spread from them into the adjacent wheat fields when the Western Provinces of Canada were brought into cultivation. The larva lives and feeds inside the stalks of the wheatplant. It moves downwards as it develops, and when it is full-grown, it spins a cocoon in the cavity of the base of the stem, and before sealing this up it cuts, just above the point where it lies, a circular incision. This incision weakens the stem, which tends to break off prematurely. The damage occasioned by this insect is very serious. In 1927, the loss due to its ravages in the Province of Saskatchewan alone was estimated to be about £2,400,000; and severe outbreaks are common in one or other of the Western Provinces. The native parasites of the Sawfly are unable to control it in the wheat fields; and it is impossible to employ any artificial methods of control against such an insect. In 1929, therefore, we suggested the introduction of the European parasites of a closely allied wheat sawfly (*Cephus pygmaeus*, L.) with similar habits. Little was then known about the natural enemies of this insect. Sample collections were therefore made in wheat fields in various parts of England. A thorough study of this material was made in order to determine the role and importance of the numerous parasitic insects associated with the Sawfly. This work showed that the parasitic wasp, *Collyria calcitrator*, was the most important factor in the control of the Wheat Sawfly in England, and that the Harpenden and Cambridge areas were the most favourable districts for its collection. Fields in which both pest and parasite were numerous were therefore selected. After the crop had been harvested, the wheat stubble was pulled up by hand and was transported to Farnham Royal. The stubble was cleaned and sorted, and all stems containing cocoons of the sawfly were removed and packed for shipment to Canada. In the winter of 1929-30, 15,000 cocoons, of which a high percentage was parasitised, were sent; 90,000 cocoons were shipped in 1930-31 and about 50,000 in 1931-32. Increased funds provided by the Government of Canada enabled us to extend the work in 1933-34. Five hundred sacks of stubble were collected and 337,250 cocoons shipped to Canada.

As the infested area in Canada is enormous and the population of the pest immensely larger than the number of parasites it has been possible to introduce, a good many years must elapse before the natural enemies exert their full effect. It is therefore quite satisfactory to be able to report that the species introduced has successfully attacked the Western Wheat-stem Sawfly, survived the Canadian winters, and reappeared for several seasons in the field in fair numbers.

In the spring of 1934, after consultation with the Dominion Entomologist about 2,000 cocoons of one of the less important parasites of the Sawfly were shipped to Canada. The results of this introduction are not yet known.

*European Corn Borer (Pyrausta nubilalis, Hübner).*—The caterpillar of this insect, introduced into North America about 15 years ago, is extremely injurious to Indian Corn and other plants. It has established itself in Ontario.

At the request of the Dominion Entomologist, the larvae of a South African Maize Borer, which had been parasitised in the laboratory by one of the most important natural enemies of this insect, were obtained from the entomologists of the Empire Cotton Growing Corporation's Experimental Station in Barberton, Transvaal. Several consignments were shipped to Canada, where the parasites were successfully reared and used in experiments with the larvae of the Corn Borer.

*Insects Affecting Deciduous Fruits.*

*Codling Moth (Cydia pomonella, L.).*—The Codling Moth is the most important insect pest of the Apple. It originated in Europe, but is now distributed over practically all parts of the world where apples are grown. The caterpillars of the Moth burrow into the fruit, rendering it practically unsaleable, having regard to the high standards of the modern market. In some apple growing countries the losses due to the Codling Moth amount to over £3,000,000 per annum.

In view of the general importance of the Codling Moth, an investigation of its parasites was initiated in the early years of the work. The difficult problem of rearing the insect in large numbers in captivity was solved, satisfactory methods for survey of the natural enemies in England and France was carried out. Owing to the financial stringency the laboratory work was eventually discontinued after one of the principal parasites (*Ascogaster quadridentatus*) had been shipped to South Africa and New Zealand. But an extensive report on the parasites, embodying the main facts discovered during the investigation, was prepared by Mr. H. T. Rosenberg, and has now been published in the 'Bulletin of Entomological Research'.

*Woolly Aphis of the apple (Eriosoma lanigerum, Hauam).*—This pest, known in England as the American Blight, is an aphid which originated in North America, but has now spread to practically all parts of the world in which apples are grown. It has, in America, an important native parasite, the Chalcid wasp, *Aphelinus mali*. This has been introduced into many apple-growing regions and has, in a number of cases, materially reduced the infestation by the Woolly Aphis. In the United Kingdom it has been distributed for a number of years by the Ministry of Agriculture, but although it has established itself in some areas, it frequently disappears at the close of the season, and requires to be re-introduced from year to year. A stock of the parasite is therefore kept on hand at Farnham Royal, and consignments, estimated to contain about 500 parasites, are supplied to apple-growers at a charge of ten shillings and six pence, including postage and packing. Satisfactory results are frequently reported. In the early summer of 1933, a colony of 100 individuals of the parasite was placed on an apple tree in the garden at Farnham Royal, with a population of Woolly Aphis estimated at 112,000, in which no parasites had been present. The condition of the aphids was followed week by week by sample dissections. In 67 days the parasitism in the samples taken rose to 100 per cent, so that the infestation was practically annihilated. Two short papers, giving an account of this and another similar and equally successful experiment, are now in press.

During the financial year 1933-34, 16 consignments of *Aphelinus* were sent to correspondents in England, while one consignment was despatched to the Egyptian Department of Entomology.

*Insects Affecting Forest Trees.*

*Bark Beetles.*—This is an extremely important group of insects affecting trees of all kinds. The damage they do is due to the fact that the adults and larval tunnel through the cambium region. Some confine their attacks to dead or dying trees, but others are able to attack and kill living, healthy trees. In certain cases the adult beetles also cause great losses by feeding upon the shoots of healthy trees. It may also be noted that a temporary weakness induced by heavy defoliation, due to leaf-feeding insects, sometimes allows the bark beetles to make a successful attack, to which the tree succumbs, though, under reasonably favourable conditions, it would have recovered from the effects of defoliation.

No serious attempts have been made in the past to utilise, or even to evaluate the work of the parasites and predators of Bark Beetles. A few years ago we therefore decided to undertake an investigation of the subject. This investigation, which is being carried out mainly in areas under the control of the Forestry Commission, and in co-operation with its officers, has three main objects:

- (1) The collection of parasites and predators of Bark Beetles for introduction into Empire countries where these pests are troublesome (Canada, New Zealand, South Africa).
- (2) The determination of the part played by beneficial insects in relation to bark beetles in England, under the present system of forest management.
- (3) The development of methods of forest management, under which the natural enemies of bark beetles can be maintained at their maximum efficiency as controlling agents.

During the financial year 1933-34, a considerable mass of data bearing on (2) was collected and experiments bearing on (3) were laid down. Early in March, 1933, a consignment of three species of predacious beetles (*Phisophagus* spp.), comprising over 3,700 individuals was sent to New Zealand. In October, 1933, a consignment of 1,066 specimens of one of these beetles was despatched to Canada. In February and March, 1934, three consignments of a parasite of bark beetles, comprising over 6,000 specimens, were sent to Canada. This material arrived in good condition in New Zealand and Canada and was liberated in the field; but no reports upon the work have as yet been received.

*Chermes* Spp.—These are aphids, somewhat resembling the Woolly Aphis of the Apple in superficial appearance, but confined to conifers. One species of the group (*Chermes pini*) introduced from Europe, now does a good deal of damage in the *Pinus radiata* forests of New Zealand, retarding the growth of the trees and sometimes causing their death. Another species (*Chermes* or *Breyfusia piceae*) causes serious injury to Balsam in Canada, where it is known as the Balsam Bark Louse.

These insects are relatively common in Europe, and rather heavy infestations by some of the species have been observed on Weymouth and Scots Pine in the Bagshot area. They are, however, preyed upon by several species of predacious insects, including lady-birds, the larvae of certain two-winged flies belonging to the family Agromyzidae (*Leucopia* spp.), and some Neuropterous insects of the family Hemerobiidae. These predators eventually became very abundant in the Bagshot area, so that in the course of a few seasons they practically wiped out the infestation.

Several consignments of one of these predators (*Leucopia obscura*) have been despatched to New Zealand (Dr. David Miller) has been unable to visit the area since the material was liberated, but the predator is known to have become established in Canada. A request for additional material has been received from New Zealand, accompanied by a promise of £30 to cover the expenses of the work, from the Directors of New Zealand Perpetual Forests Ltd.

*European pine-shoot moth* (*Rhyacionia buoliana*, Schiff).—This is a small moth belonging to the Tortrix family. Its larvae attack several species of pine, and frequently cause serious damage, especially in young plantations; by boring into and destroying the young shoots. When the terminal shoot is affected, as it often is, the replacement of the original leader by a side shoot follows and this causes a more or less pronounced kink or bend in the main stem, which often persists throughout the life of the tree, and very seriously lessens its market value. The Pine-shoot moth is a European insect, but was accidentally imported into the United States and Canada a number of years ago.

A first consignment of material of this species containing several species of parasites, was despatched to Canada in 1928. Several species were liberated and have become established in the infested areas; but as the infestation has continued to increase the Dominion Entomologist instructed us to secure more material. In the summer of 1933 new collections were therefore made and shipments containing a total of about 530,000 specimens were sent to Canada. From these large numbers of parasites were reared and liberated; but no reports on the results have yet been received.

*White Spruce Sawfly* (*Diprion Polytomum*, Htg.).—This sawfly is a European species, but though it has occasionally done some damage, it is rarely of any importance. Several years ago, however, it suddenly appeared in some valuable Canadian spruce forests, in the Gaspé Peninsula, south of the St. Lawrence River, and has spread with unusual rapidity. Its larvae eat the needles of the spruce trees and these, like the majority of conifers, suffer very severely when they are defoliated. One result of the injury is to slow up the movement of sap in the trees, which then become more susceptible to the attack of bark beetles. In healthy trees, where the rate of sap flow is normal, the injury caused by the beetles in making their tunnels causes a heavy flow of resin which may trap and stifle the beetles in their galleries, while those attacking sickly trees are able to continue their excavations, weakening the tree still further, and sometimes killing it.

Owing to the relatively inaccessible character of the area invaded by the Spruce Sawfly, artificial measures of control are impracticable. The distribution of poisonous dusts by aeroplanes has been considered, but its cost would be in the neighbourhood of £80 a square mile, and as some 7,000 square miles are affected the method is impracticable. Early in 1932, the Dominion Entomologist therefore requested the Laboratory to undertake a search for the parasites of the insect in Europe. This work was carried out by Messrs. K. R. S. Morris and W. F. Jopson in 1932, and by Messrs. Morris and E. Cameron in 1933 and 1934. *Diprion polytomum* was found to be uncommon everywhere. Three thousand three hundred and twenty-two cocoons

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A correspondence and exchange of views with regard to the Biological control of the Small Moth Borer of Sugar-cane has been maintained with Mr. R. W. E. Tucker, Entomologist of Barbados, Mr. H. E. Box, Entomologist of Antigua, and Mr. I. D. Cleare, in charge of the special investigations on Small Moth Borer in British Guiana.

*Bermuda.*—We have been consulted by the Department of Agriculture of the Bermudas in regard to the control of the Palmetto Scale, and have forwarded recommendations for its investigations, which have been adapted.

*Mauritius.*—Mr. W. F. Jepson, originally a member of the Laboratory staff, was seconded to the Mauritius Government in 1932, to undertake work on the biological control of *Phytalus smithi*, the white grub of sugar-cane. Following a plan of campaign drawn up at the Laboratory, Mr. Jepson visited the United States and Porto Rico, where he studied the methods of handling the parasites of white grubs, and obtained supplies of several parasites and predators of various white grubs. These were transported, *via*, Farnham Royal, to Mauritius where Mr. Jepson is continuing the investigations under our general supervision.

*Kenya.*—We have been consulted during the past year by the Department of Agriculture of Kenya, with regard to the biological control of the Coffee Mealybug, and have submitted plans, which are now under consideration.

*Australian Investigations.*—Mr. Stanley Garthside, of the Entomological Division of the Commonwealth Council for Scientific and Industrial Research, assisted by Mr. Frank Wilson, have continued their investigations of the natural enemies of Australian Noxious Weeds and insect pests, under the general supervision of the Superintendent, and have despatched large consignments of a number of beneficial insects to Australia, where some species have now been liberated. Investigations and collections are always made in collaboration with the Australian entomologists when the occasion arises.

#### *Visiting Entomologists.*

Among the many visitors to the Laboratory during the year were entomologists from Malaya British Solomon Islands, India, and the West Indies, France and Denmark, as well as organised parties of students from Public Schools and Colleges.

Arrangements were made for the visit of Mr. H. D. Nangpal, the Special Research Assistant, Pink Bollworm Investigations, United Provinces Entomological Research Scheme to the Laboratory for a period of two months. (1).

#### *Staff.*

With the resignation of Mr. H. T. Rosenberg, the staff of the Laboratory now numbers eleven, including the Superintendent, three Junior Entomologists, one Field Entomological Officer, one Secretary-Accountant-Librarian, one Caretaker, one Gardener, one Cleaner, and three Laboratory boys.

#### *Library.*

Owing to the financial stringency, the library of the Laboratory has not been added to, other than by bound volumes and parts of the current periodicals on the work, and various separates sent in exchange for Laboratory contributions or presented to the Laboratory. The number of bound volumes is now 612 and the number of separates 3,457.

#### *Equipment.*

As with the library, it has been impossible to add to the standing equipment of the Laboratory during the financial year under review, owing to lack of funds.

#### *Parasite Catalogue.*

Work on the Parasite Catalogue, which shows all records of parasites and predators, their hosts, and the country of records, as shown in the "*Review of Applied Entomology*", Series A and B, has been continued by Mr. R. C. Jeffery. It is estimated that these Catalogues now contain approximately 60,000 cards.

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(1) Mr. Nangpal was occupied for the months of May and June at the Laboratory studying the various aspects of our work.

## ENCLOSURE II.

STORED PRODUCTS RESEARCH LABORATORY.

## REPORT ON WORK FOR THE YEAR.

30th September, 1933, to 1st October 1934

*Introductory.*—During the year the main problems investigated by the Laboratory have concerned the infestation of tobacco by *Ephestia elutella* and of dried fruit by *Plodia interpunctella*.

The work on both problems was undertaken in the first instance at the request of overseas Governments of industrial firms, namely the Southern Rhodesian Government and the Australian Dried Fruits Board. Since the inauguration of the work other governments and industrial firms have shown their concern or interest in these problems and have contributed towards the conduct of the research. It is of interest to record that Imperial Chemical Industries have this year given a special grant for the investigation of the use of hydrocyanic acid gas as a dried fruit fumigant and that the Port of London Authority has asked for a special investigation of the insect conditions prevailing in their tobacco warehouses. It may therefore be claimed that all the work of the Laboratory is being carried out on behalf of overseas Governments of companies as well as for industrial firms in the home country.

The present position regarding these two major problems is as follows:—

*Infestation of Dried Fruit.*—The crux of this problem is how to reduce the numbers of the insects which form a resident population in the warehouses at Millwall. When the Slough Laboratory undertook to assist the Australian Dried Fruits Board in dealing with the infestation problem a new system was established. Ethylene oxide was substituted for the Plumbridge mixture for use in barge fumigation and the empty warehouses were fumigated, some with hydrocyanic acid gas, others with ethylene oxide. It was realised at the time that this fumigation of the empty warehouses would not be completely effective, because there was no information anywhere available regarding the behaviour of fumigant gases in large spaces, and that a certain proportion of the very heavy infestation of the warehouses which had accrued during the Plumbridge regime would have to be dealt with in the spring and summer. It was realised that the fumigation of warehouses containing fruit would be too costly and in our present state of knowledge too uncertain to be practicable. Accordingly the insect population remaining in the warehouses had to be dealt with by other means than by fumigation.

There were therefore two main lines of work to be carried out; the first dealing with the improvement of barge fumigation of fruit and the problems arising in that work and the second concerned with the devising of control measures, other than fumigation, against the insects occurring in the warehouses themselves. In addition, there was the usual routine inspection of fruit after large fumigation to check results.

*Infestation of Tobacco.*—The early history of the infestation of tobacco and an account of the work done up to 1933 is given in Dr. Bovingdon's report (E. M. R. 67) published in July 1933. Since that date the full extent of the infestation throughout all the tobacco-growing countries has become clearer. There seems to be little doubt that the moth *Ephestia elucella* has been a pest of tobacco in the Near Eastern and Mediterranean countries for a number of years and that this area may be regarded as the source of the now world-wide occurrence of infestation in the tobacco trade. Unfortunately, this does not relieve other countries or areas of their difficulties. But it is helpful in this respect that we have now a better understanding of what this problem really is.

It was obviously necessary to investigate further methods of controlling infestation of tobacco in warehouses and here again the work done consists in further study of fumigation methods, study of other means of controlling infestation of warehouses and inspection work at the docks to determine the status of infestation from time to time.

## PROGRESS OF WORK.

*Infestation of Dried Fruit.*

(1) *Laboratory Work.*—The laboratory work is divisible into two sections; entomological and chemical. Because the entomological work done is the same whether the products concerned are dried fruit, tobacco, or cocoa it is convenient to consider it first.

The entomological work is concerned chiefly with detailed studies of the biology of the *Phycitid* moths of the genera *Ephestia* and *Plodia* and of certain beetles such as the grain weevil which are of secondary importance to the *Phycitid* moths. Good progress has been made in this work and as a result ample stocks of insects have been reared for experimental purposes. At first sight this appears a minor contribution towards the control of insect infestation but it cannot be too strongly emphasised that unless large numbers of insects are available for experimental work control methods cannot be properly undertaken. Indeed I believe it is correct to say that the entomological work which has made really large numbers of insects available for experimental work notably in the study and testing of control measures is a chief merit of the Laboratory's research.

Apart from supplying insects for investigations within the Laboratory we have also been able to provide stocks of insects for work on insecticides now being undertaken in the laboratory of Imperial Chemical Industries and to provide insects for work on the control of bed-bugs which present a special problem in alum clearance.

The experimental entomological work at Slough—is hampered for lack of special apparatus notably a range of incubators for the study of the effects of temperature on the rate of development.

The chemical work of the Laboratory has been concerned with further study of the methods of determining fumigants in the aid space of determining residual fumigant in stored products. Special attention is being given to problems arising in the use of hydrocyanic acid as a fumigant for dried fruit. The reason for this work is that although ethylene oxide continues to be satisfactory it is too expensive to be used for the fumigation of fruit in large warehouses and it is unlikely to be used on a large scale overseas, as for instance in Australia. The advantage of ethylene oxide is that the residues left in the fruit are, so far as is known from a study of the literature and from practical experience, innocuous. Hydrocyanic acid on the other hand has been said to produce cyanhydrins in dried fruit and very little is known concerning this question and its importance in food stuffs. It is satisfactory to be able to report that this special work is being financed by Imperial Chemical Industries.

Other work in the Chemical Section is concerned with the study of the moisture content of dried fruit under varying conditions of stowage and the Australian Dried Fruits Board has provided for a special assistant for this work.

Further investigation of apparatus for the delivery or release of fumigant gases—of which ethylene oxide and hydrocyanic acid are much the more important—has been undertaken and an improved type of apparatus for use with ethylene oxide has been devised for use by the Australian Dried Fruits Board.

Special work which has received some attention and will be further followed up as funds and opportunity allow concerns the study of the suitability of various building materials for the construction of fumigation chambers and warehouses and other buildings. Work on these problems has been suggested to us by the Port of London Authority and other Warfingers.

An urgent need of the chemical section at Slough is a large fumigation chamber for the conduct of experiments intermediate between laboratory work and wholesale commercial work.

Special attention has been given to the devising of an insecticide spray to deal with the insects surviving in the warehouses. Originally a proprietary spray consisting of extract of pyrethrum in white oil was used for this work but was not found to be wholly satisfactory. Intensive work has been carried out and a much better insecticidal spray has been produced and is now in general use at Millwall. The spray is applied under pressure in the form of a fine mist and is used primarily against moths emerging from crevices in the brickwork and plaste and from the dunnage and other materials present in the warehouses.

(2) *Field Work*.—Field work undertaken in investigating the infestation of dried fruit has been concerned mainly with sampling of fruit to arrive at a knowledge of the status of infestation, of the efficiency of barge fumigation and of the insecticidal spray. The chemical section has been concerned with occasional analysis of fumigant, occasional testing of barge fumigation and field experimental work directed towards the improvement of fumigation methods.

Field work has also been carried out in the ports of Bristol and Glasgow relating to fumigation problems and infestation of warehouses.

A marked improvement has been achieved in the storage of Australian dried fruit. Ten years ago the Australian Dried Fruits Board adopted a system of fumigation and this for a time appeared to check infestation. Soon, however, it became evident that the system had various defects and the Slough Laboratory was asked to investigate the general problem but especially the question of fumigation. Subsequently the original Plumbridge fumigation system was abandoned and the present system was abandoned and the present system adopted on the recommendation of the Laboratory. The reduction in infestation has been marked and it is felt that better results will be achieved next year. It may even be safe to say that the system now in use by the Australian Dried Fruits Board is one of the most, if not the most, efficient in the dried fruit industry.

In concluding this brief account of the dried fruit work our thanks should be expressed to the Australian Dried Fruits Board and their staff for the many facilities given us for investigational work and for their whole-hearted co-operation throughout.

#### *Infestation of Tobacco.*

(1) *Laboratory Work*.—The experimental work relating to the infestation of tobacco has followed similar lines to those of the dried fruit work. A special study has been made of hydrocyanic acid gas as a fumigant for tobacco, particularly with reference to residues remaining in the tobacco and their effects on aroma, flavour and smoking qualities generally. The results of the work show that the normal dosages given for tobacco fumigation are too low to penetrate fully into bales and hogsheads at a concentration lethal to all stages of *Ephestia*. Higher dosages can, however, be given without affecting aroma, flavour or smoking qualities. On the other hand one of the more important tobacco manufacturers hesitates to use hydrocyanic acid in this country and has asked that ethylene oxide be further investigated for this purpose. This work is being undertaken.

The work done has included actual fumigation experiments especially to determine the penetration of the gas in bales and hogsheads and also to ascertain the amount of residual hydrocyanic acid left behind on fumigation at high concentrations.

As has already been explained, infestation of warehouses is a most important problem and special experimental works has been undertaken to determine whether the insecticidal spray used in the dried fruit warehouses can be safely used in tobacco warehouses where taint from the oil might have been feared. It is satisfactory to report that this spray can be quite safely used in tobacco warehouses and that it has been approved by one of the big tobacco combines. Experiments have also been carried out to ensure that no fire risks attached to the use of this spray and here again results are wholly satisfactory.

(2) *Field Work*.—The field work carried out in the tobacco warehouses has been undertaken mainly to ascertain to what extent infested tobacco still arrives in this country and to what extent certain warehouses in London are infested by the moth *Ephestia stictella*. With regard to the first question it has been shown that where infestation is high in the packing sheds of the producing country correspondingly high infestation is shown in the tobacco on arrival in London. This tallies remarkably with results obtained two years ago in investigating dried fruit problems and almost warrants the assumption that there is a direct correlation between infestation in the producing country and infestation on arrival at the home ports.

In sampling tobaccos arriving in London to determine the amount of infestation it was found that certain tobaccos affording distinct evidence of having been fumigated in the country of origin still harboured living *Ephestia* larvae. This confirms our opinion that in the United States of America, and probably elsewhere also, the dosage given during fumigation do not allow sufficiently for such causes of reduced concentration as leakage, absorption and poor penetration. It is evident that dosages of 15



ounces of hydrocyanic acid per 1,000 cubic feet of space are far too low for efficient fumigation of tobacco and that 24 to 30 ounces may be necessary. ...

A special investigation of the tobacco warehouses of the Port of London Authority was undertaken in the early summer. The full results of this are not yet available but it is gratifying that the Port of London Authority are now taking an active interest in infestation problems.

In dealing with tobacco as with dried fruit the study of infestation of warehouses has received special attention and it may be useful to explain why this is important. Infestation occurs in the producing country, during transport and during storage in the importing country. Even if the first two types of infestation were dealt with commodities imported into infested warehouses would still run the very real risk of infestation during storage there. At the same time it is evident that methods for the control of insects in the warehouses in the home country will with slight modification apply to infestation during transit and infestation in the producing country. Accordingly it is quite proper that the Slough Laboratory should concentrate on this problem, and in fact this view has recently been endorsed by the Australian Dried Fruits Board which, when it was suggested that parallel investigations to those in progress in the Slough Laboratory should be carried out in Australia decided that it was more important to strengthen the Slough staff and hasten its work than to have two parallel investigations going on at a slower pace.

For similar reasons it was felt that it was more expedient to concentrate on the two products dried fruit and tobacco than to extend the work to other produce such as grain. A stage has now been reached in the work when the problems are becoming more technical and the solution of any one of them will apply not merely to products immediately concerned but to stored products generally. For example the special spray devised for dried fruit warehouses has been found to be immediately applicable to tobacco warehouses and with minor modifications will probably be applicable generally. The scientific principles underlying fumigation and the use of insecticides now under investigation form the background for control work not only in dried fruit and tobacco infestation but in all forms of infestation.

#### *Miscellaneous Investigations.*

A study of the biology of the house mite, *Glycyphagus domesticus*, undertaken on behalf of the High Wycombe and District Furniture Manufacturers Federation has been completed and it is evident that the eradication of this mite in the furniture trade depends on proper treatment of Algerian fibre with certain dyes which will inhibit the fungal growth which forms the main food supply of the mite. This question will be further investigated as funds and opportunity permit.

Work on the resistance of insects to fumigants has been continued. A satisfactory apparatus has now been devised for studying the toxicity of fumigants and experimental work on the grain weevils (*Sitophilous* species) and on the bed-bug (*Cimex lectularius*) has made good progress.

Work has been begun on the action of insecticides and will be continued.

Vacuum fumigation has received some attention and in particular a special type of vacuum chamber has been devised which is adopted for the fumigation of small quantities of stores. This work was carried out at the request of the Department of Agriculture in Trinidad, to whom a chamber has now been sent by the engineering firm with whom we co-operated.

At the request of the Forest Products Research Laboratory of the Department of Scientific and Industrial Research a special programme of work on the fumigation of timber against wood-boring insects has been arranged and will be carried out in co-operation with that Laboratory.

#### *Industrial Relations.*

The general problem of infestation and its control still presents the difficulty arising from the unwillingness of some of the parties concerned to accept responsibility for infestation or to recognise that all the parties involved must co-operate in dealing with infestation. This difficulty is being gradually overcome and it is hoped that, if the good progress made in the control of dried fruit infestation justifies publicity, being given to that work, industrial firms which are still hesitant may be induced to take action. The nature of the work done at the Slough Station has of course rendered publicity difficult but it is hoped that a fuller appreciation of the value of the work in all quarters may overcome this disadvantage.

*Importance of the work to the Various Governments or Government Departments and Companies Overseas.*

While it is easy to assess the value of *ad hoc* investigations for particular countries or industries it is always difficult to assess the value of basic research work. On the other hand the work done at Slough on the behaviour of gases under different conditions such as occur in vacuum chambers, barges, ships and warehouses; on the methods of determining gases or vapours like ethylene oxide, hydrogen cyanide and orthodichlorobenzene; on the determination of residues of these substances absorbed and retained by various products; on the formation of cyanhydrins in fruit and other products; on the resistance of insects to fumigants and other insecticides and to high and low temperatures; and on the behaviour, development and physiology of insects; is of interest to all workers not only on stored products infestation but on economic entomological problems generally. In the long run this work is more important than the temporary control of an outbreak of empirical methods.

It is a defect of empirical work that it does little to advance knowledge and while, as is shown by the work for the dried fruit and tobacco industries, empirical work necessarily figures very largely in the programme of the Slough Station it is more and more evident what the basic problems underlying infestation are and how important and urgent the need is for research on them. In so far as possible, the longer range basic research work is borne by a private benefaction, made to the Slough Station when the Empire Marketing Board was abolished, but it is felt that government departments or industrial companies both at home and overseas ought to contribute something towards that kind of work which is essential even to *ad hoc* investigations. It is not sufficiently realised that neglect of basic research work in the past is responsible for the lack of knowledge which in almost every problem handicaps the economic entomologist.

Basic research is quite properly best undertaken in university institutions, in government research institutes or in the research laboratories of industrial firms. These last two play a very important part in the physical and chemical sciences but because the biological sciences are only now entering manufacturing industry as distinct from agriculture, their importance is as yet not sufficiently realised. The result is that the background or basic research work on which the economic entomologist must build is still too limited. The university zoology departments as a whole have found the best outlet for their graduates in medicine or in research basic to medicine and in consequence the basic research which they have done has been suggested by the needs of medicine. The Imperial College is unique in that its department of zoology and applied entomology to which the Slough Station is attached has been built up independently of medical teaching and medical science. On the other hand it has not had the advantage of the support which medical science can give and is almost wholly dependent for support on those interested in industrial problems. The consequence is that increased support from industry for the Slough Station will come slowly and meanwhile it is urgently necessary to secure adequate financial support for the nucleus staff engaged on basic research.

The work carried out at Slough during the past year is of direct interest and importance to all those government departments and companies concerned with dried fruit problems such as Australia, South Africa and Canada, to those concerned with tobacco problems such as Southern Rhodesia, Nyasaland, Australia, South Africa and the home country, and because of the good progress made in the study of fumigation and other control methods to those countries interested in the infestation of grain and leguminous seeds, a problem which is present in all the countries of the British Empire.

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III Penetration of hydrogen cyanide into bags of raw cacao stacked in piles of different sizes.  
J. Soc. Chem. Industry, Vol. LII, No. 40, 1933.
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## APPENDIX V.

NOTE, DATED THE 16TH JANUARY 1935, BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT NO. 12.—(i) REPORT ON THE DEPUTATION ABROAD OF DR. B. N. UPPAL, PLANT PATHOLOGIST TO THE GOVERNMENT OF BOMBAY, FOR THE STUDY OF VIRUS DISEASES OF PLANTS. (ii) REVIVAL OF DR. UPPAL'S SCHEME OF INVESTIGATIONS INTO THE VIRUS DISEASES OF PLANTS ORIGINALLY SANCTIONED BY THE COUNCIL WITH CERTAIN MODIFICATIONS INTRODUCED BY DR. UPPAL AS A RESULT OF HIS DEPUTATION ABROAD.

At its meeting held in January 1931, the Advisory Board approved a scheme of investigations on virus diseases of plants, by Dr. B. N. Uppal, Plant Pathologist to the Government of Bombay (*vide* pages 23 and 124-29 of the printed proceedings of that meeting). As recommended by the Board, an estimate of expenditure on the scheme was prepared in consultation with the Director of Agriculture, Bombay, and a grant of Rs. 2,350, non-recurring and Rs. 63,040 recurring or a total of Rs. 65,390 spread over a period of five years was sanctioned by the Governing Body in May 1931. Owing, however, to financial stringency the inauguration of the scheme was postponed. Advantage was taken of this opportunity to depute Dr. Uppal abroad for the study of virus diseases of plants (Please see pages 23 and 219-221 of the printed proceedings of the meeting of the Advisory Board held in July 1932.) Dr. Uppal left India on the 12th June 1933 and returned back on the 8th June 1934.

2. Attention is now invited to the undernoted correspondence with the Government of Bombay (Annexures I-III). It will be seen that in his report on foreign deputation which forms an enclosure to the Bombay Government's letter dated the 13th December, 1934, Dr. Uppal has suggested certain changes in the staff included in the original scheme which involve an increase of Rs. 2,460 over the original estimate of cost of staff. He has also suggested the provision of a glass house costing Rs. 12,624. The Government of Bombay strongly support Dr. Uppal's proposal for additional staff and the provision of a glass house and request that the main scheme with the proposed additions may be revived now. The estimated cost of the scheme including the additions may be revived now. The estimated cost of the scheme including the additions referred to comes to Rs. 80,474.

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

## ANNEXURE I.

EXTRACT FROM BOMBAY GOVERNMENT LETTER No. 1156-A./28, DATED THE 6TH JUNE 1934, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.

I am directed by the Government of Bombay (Transferred Departments) to state that the Imperial Council of Agricultural Research sanctioned in June 1931 a grant of Rs. 65,390, spread over a period of five years, for a scheme of virus diseases of plants. Preliminary arrangements were taken in hand, but in February 1932, the Research Council asked that the inauguration of the scheme should be postponed, as owing to severe financial stringency, the Government of India had suspended their annual subsidy to the Council. Accordingly the scheme has not so far been launched. Advantage was taken of the postponement to depute abroad Dr. B. N. Uppal, Plant Pathologist, who will control the research, to study the latest advances in scientific knowledge pertaining to the virus diseases of plants, with a grant of £500 sanctioned by the Imperial Council of Agricultural Research for the purpose. Dr. Uppal has reported that it will be useless to attempt any work on plant viruses without a suitable glass house. The question of applying for the exact amount of additional funds for the construction of the glass house has been held over till his return from leave. The Bombay Provincial Agricultural Research Committee recently recommended that the main scheme should be revived as soon as Dr. Uppal returns from abroad. I am to add that the Government of Bombay support the recommendation and request that the Imperial Council of Agricultural Research may be moved to make the necessary funds available for the purpose.

1. Letter from Bombay Government, No. 1156-A./28, dated the 6th June 1934 (Annexure I).
2. Letter to Bombay Government, No. F. 37/33/Agri., dated the 3rd October, 1934 (Annexure II).
3. Letter from Bombay Government, No. 4675/28, dated the 13th December 1934, and enclosures (Annexure III).

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## ANNEXURE II.

COPY OF LETTER FROM SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH,  
TO THE SECRETARY TO THE GOVERNMENT OF BOMBAY, REVENUE DEPARTMENT, BOMBAY,  
No. F-37/33/AGRI., DATED THE 3RD OCTOBER 1934.

*Subject* :—Scheme of investigations into the virus diseases of plants.

With reference to your letter No. 1156/A/28, dated the 6th June 1934 (Annexure I), I am directed to state that the Vice-Chairman, Imperial Council of Agricultural Research is of the view that before the revival of the scheme mentioned above is sanctioned the report of Dr. Uppal on his deputation abroad which was required to be submitted *vide* para. 1 (iv) of this Department letter No. 2468/Agri., dated the 21st October 1932, should be awaited. It is likely that as a result of experience of the work done in foreign countries on virus diseases, Dr. Uppal may find it necessary to modify the programme of research work and introduce some changes in the apparatus, etc., included in the sanctioned scheme of investigations. I am accordingly to request that this Department may kindly be furnished with a copy of the report referred to above as soon as possible and also informed whether any changes are considered necessary on the scheme in view of the information obtained abroad by Dr. Uppal.

## ANNEXURE III.

LETTER FROM THE SECRETARY TO THE GOVERNMENT OF BOMBAY, REVENUE DEPARTMENT,  
TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 4675-A/  
28, DATED THE 13TH DECEMBER 1934.

*Subject* :—Scheme of investigations on Virus Diseases of plants.

With reference to the correspondence ending with your letter, No. F-37-33-Agri., dated the 3rd October 1934 (Annexure II), I am directed by the Government of Bombay (Transferred Departments) to forward a report (Enclosure) on the deputation abroad of Dr. B. N. Uppal, Plant Pathologist, for the study of virus diseases of plants and to state as follows.

2. In the concluding portion of his report Dr. Uppal has indicated the changes which he considers to be necessary in the scheme of investigations into the virus diseases of plants. They involve an increase of Rs. 2,460 over the cost of Rs. 38,040 for pay of staff originally estimated. This is mainly due to the inclusion of provision for pay of an Assistant Entomologist whose services are considered essential for the successful working of the scheme. The provision of a glass-house is also considered essential for use in investigations on plant viruses. The cost on this account is estimated at Rs. 12,624. In this connection, I am to forward for your information a copy (with 150 spare copies) of a note (Enclosure II to Annexure III) by the Plant Pathologist on the glass-house for the virus diseases scheme which gives details of the expenditure. I am to add that the Government of Bombay strongly support the proposals for additional staff as well as the provision of a glass-house and request that the Imperial Council of Agricultural Research may be moved to make the necessary funds available for the purpose.

Enclosure I to Annexure III.

REPORT ON THE DEPUTATION ABROAD TO STUDY VIRUS DISEASES IN PLANTS BY DR. B. N. UPPAL, PLANT PATHOLOGIST TO THE GOVERNMENT OF BOMBAY.

I arrived in England on Saturday, the 24th June, 1933, and left for the Rothamsted Experimental Station at Harpenden after seeing Dr. E. J. Butler, Director, Imperial Mycological Institute, Kew, Surrey, England.

*Rothamsted Experimental Station.*

The work in virus diseases of plants at the Rothamsted Experimental Station is under the charge of Dr. J. Henderson Smith, an eminent authority on this subject. He has three principal assistants for the virus work :

Dr. John Caldwell	Plant Physiologist.
Dr. F. M. L. Sheffield	Cytologist.
Dr. Watson	Entomologist.

Dr. Caldwell is engaged mostly on research on the physiological aspects of the virus of tomato aucuba mosaic and the movement of this virus through the plant tissues. His work on this subject is well known and has been published mostly in the *Annals of Applied Biology*. The work of Dr. Sheffield on the formation of intracellular inclusions or X-bodies in *Solanum nodiflorum* infected with the virus of tomato aucuba mosaic attracted attention a few years ago, and she has recently obtained evidence on the inanimate nature of these bodies, which she has been able to induce in the cells of *Solanum nodiflorum* in the absence of a virus, by treating the plants with ammonium molybdate. Dr. Watson (formerly Miss Marion Hamilton), who is a trained entomologist, is attempting to elucidate the relation of the insect-vector to successful transmission of a virus in respect of its dosage.

In recent years attempts have been made to determine the size of particles of plant viruses. For this purpose porcelain candles are unsuitable, since adsorption plays a very large part in virus filtration. In order to avoid this and other disadvantages, ultra-filtration is usually employed. Using Elford's technique for making collodion membranes, MacClement and Henderson Smith have investigated the size of a number of plant viruses. The making of standardised collodion membranes is a somewhat difficult operation, and I spent about a week late in September 1933 with Dr. S. J. Folley, National Institute for Research in Dairying at Shinfield near Reading, for this purpose.

Besides the permanent staff at Rothamsted, Dr. J. M. Firkeland, a Fellow of the National Research Council of America, was working with various purified virus preparations, against which rabbits were immunized. In a previously published work Dr. Firkeland has already shown by means of cross precipitin tests and precipitin adsorption tests (1) that viruses may be freed from antigenic constituents of healthy plants by several methods of purification, (2) that juice from virus plants contains, in addition to the antigenic constituents of normal plants, an antigenic fraction, which was inseparable from the virus, and (3) that this antigenic fraction appeared to be specific for a particular virus. He has thus been attempting to show that the serological technique is of value in the differentiation of plant viruses.

Early in July 1933, a conference on virus diseases was held at the Rothamsted Experimental Station with Dr. G. H. Pethybridge, of the Ministry of Agriculture and Fisheries, in the chair. A most interesting paper was read by Dr. H. H. Storey, Plant Pathologist, East African Research Station, Tanganyika Territory, on the mechanism of transmission of maize streak by the leaf hopper *Cicadulinambia*; this work has now been published in the Proceedings of the Royal Society and is probably the most important contribution on this subject. Dr. Salaman and his associates (from Cambridge) reported to potato viruses. Dr. Caldwell (Rothamsted) explained his experiments (recently published) on respiration in tomato plants infected by aucuba mosaic. Dr. Sheffield briefly referred to her success in inducing intracellular inclusions in the cells of *Solanum nodiflorum* in the absence of a virus.

In July I also visited the University of Reading to attend a meeting of the Economic Biologists, and the Research Station of the Imperial Chemicals Ltd., at Jealott Hill.

In October I visited the Experimental and Research Station, Cheshunt, Herts, in company with Dr. Henderson Smith, to acquaint myself with the virus diseases of glass-house plants. We discussed many interesting subjects with Dr. W. F. Bewley, the Director, especially the relation of tomato stripe to the associated *Bacillus lathyris*, although Dr. Henderson Smith has experimentally shown that this species of bacterium is not the cause of the disease. There is a possibility that tomato stripe is caused by a virus complex. I also saw specimens of the spotted wilt in tomatoes, the Australian disease which has been found on tomatoes in England after it had been described by Samuel in Australia.

Besides frequent conferences and discussions with virus workers at Rothamsted, I was engaged on problem on "The adsorption and elution of cucumber mosaic virus", the results of which have been published in the August (1934) number of the *Indian Journal of Agricultural Science*.

For the investigation of virus diseases, a number of insect-proof glass-houses have been built at the Rothamsted Experimental Station, the cost of these houses having been met partly from a grant from the Rockefeller Foundation of America. There are also insectaries where non-viriferous insects are reared for experimental purposes. I had frequent conferences with Dr. Henderson Smith in regard to the advisability of building insect-proof glass houses for the virus research at Poona, and he strongly supported my view in a letter to Dr. W. Burns, Director of Agriculture, Bombay Presidency, that for modern virus research a glass house was an indispensable piece of

equipment (Enclosure I-A to this report). Proposals for the construction of a glass house at Poona at a cost of Rs. 12,624 have already been submitted to the Imperial Council. This house is insect-proof and is designed to provide adequate ventilation for the normal growth of experimental plants. The frame-work of the house will be made in England by the famous firm of Messrs. Mackenzie and Moncur, London, and it will be assembled in Poona departmentally.

Until last year investigations into virus diseases of plants were carried out mainly at the following centres in Great Britain and were financed from grants made by the Empire Marketing Board :—

Rothamsted Experimental Station . . . . .	General aspects of virus diseases.
Potato Virus Research Station, Cambridge . . . . .	Potato viruses.
The Scottish Society for Research in Plant Breeding, Corstorphine, Edinburgh . . . . .	The Physiology of the virus diseases of the potato.
Department of Plant Pathology, Albert College, Glasnevin, Dublin . . . . .	Virus diseases of the potato, and cytology of affected plants.

This work is soon likely to pass under the direct control of the British Government since the Empire Marketing Board has been wound up.

I was at the Rothamsted Experimental Station from June to November 1933, and left for America early in December.

#### *The United States of America.*

I arrived in New York on the 11th December 1933 and left for Princeton the next day. The town of Princeton, about 50 miles distant from New York, is the seat of a famous American University, Princeton University, of which the late Woodrow Wilson was once the President. About three miles away from this town are situated the laboratories of Animal and Plant Pathology of the Rockefeller Institute for Medical Research, which has magnificent laboratories in New York where work on human viruses is conducted.

#### *Rockefeller Institute for Medical Research, Princeton, N. J.*

Excellent facilities for research on plant viruses are available at the Rockefeller Institute for Medical Research, the special feature of which is that it concentrates on the investigation of virus diseases *in general*. This is indeed a great advantage to a worker on plant viruses, who has unrivalled facilities for consultation and conferences with research workers dealing and animal and human viruses in the same institution. There is a large staff in the section on plant viruses, and the programme of work is both varied and large. The head of the section of Plant Pathology is Dr. L. O. Kunkel, with whom is associated Dr. F. O. Holmes, one of the ablest workers on plant viruses in America.

The following is the staff of the Plant Pathology section :—

Dr. L. O. Kunkel . . . . .	Head.
Dr. F. O. Holmes . . . . .	Zoologist, general work on plant viruses.
Dr. W. C. Price . . . . .	Botanist, general work on plant viruses.
Dr. H. T. Osborn . . . . .	Entomologist.
Dr. E. L. Spenser . . . . .	Plant Physiologist.
Dr. W. M. Stanley . . . . .	Chemist.
Dr. K. S. Chester . . . . .	Serological work on viruses.
Dr. H. H. Thornberry . . . . .	Ultrafiltration work in plant viruses.

The following is a brief summary of the work in hand :—

(1) Dr. Kunkel was working on (i) the immunity acquired by tobacco plants infected with the virus of tobacco mosaic or the attenuated strains of aucuba mosaic virus against the unattenuated tomato aucuba virus, (ii) isolations of pure lines from a known mixture of viruses of aucuba and tobacco mosaic through necrotic lesions produced by inoculation on *Nicotiana sylvestris*, and (iii) on the insect vectors of peach and aster yellows.

(2) Dr. Holmes had isolated a masked strain of ordinary tobacco mosaic, which was similar in properties to the latter but differed in being symptomless, i.e., it did not produce mottling in tobacco leaves on inoculation. He was also investigating the genetics of resistance to tobacco mosaic virus in *Capsicum frutescens*, and his results indicated that resistance was due to a single pair of factors and was dominant.

(3) Dr. Price was continuing his studies on the ring spot of tobacco, which becomes systemic and also produces local lesions in tobacco, *Nicotiana glutinosa* and *N. sylvestris*, but these hosts ultimately recover from this virus. However, *N. glutinosa* is a very useful host for separating ring spot from ordinary tobacco mosaic virus, since the latter only produces local necrosis in *N. glutinosa*. Ring spot also produces local and systemic infection in beans, cowpea, etc., but these hosts are ultimately killed by this virus.

Dr. Price has also isolated 7 strains of cucumber mosaic virus, which are similar in physical properties but different in their symptom expressions on tobacco. One strain produces necrotic lesions in tobacco, five strains produce systemic infection, and another produces both systemic and local infection.

(4) Dr. Osborn was working on (i) the insect vectors of pea mosaic in horse bean, (ii) incubation period of this virus in aphid, and (iii) differentiation of several pea mosaics.

(5) Dr. Spencer was attempting to establish a relation between the nutrient requirements of a plant and its resistance or susceptibility to a particular virus. His results indicated that high contents of K in the soil were correlated with increased green weight of tobacco plants and ultimately with their resistance to ordinary tobacco mosaic. The plants receiving large amounts of N did not, however, show resistance to tobacco mosaic virus.

(6) Dr. Stanley was studying the effects of chemicals (lead acetate, ammonium sulphate and safranin), temperature and H-ion concentration on the separation and purification of viruses from their plant constituents.

(7) Dr. Chester has been perfecting a serological technique for differentiating plant viruses, and his results confirm the findings of Dr. Birkeland at Rothamsted.

(8) Dr. Whit had obtained very interesting results with the "tissue culturing" of tobacco mosaic virus. When bits of tobacco roots infected with tobacco mosaic virus were grown in a special culture medium (results recently published) they continued growth and the virus multiplied actively under controlled, aseptic conditions in the apparent absence of chlorophyll. The idea is similar to "tissue culture" as commonly practiced in animal viruses.

(9) Dr. Thornberry was studying the filtration and ultrafiltration of tobacco mosaic virus. The facts established with filtration through various grades of Berkefeld candles were largely the quantitative determinations of the amount of virus filterable through the filters under various conditions of filtration. As regards ultrafiltration of the virus, the Bechhold collodion membranes were utilised, but they were found to be inadequate in uniformity of pore size for accurate studies. They were, however, easily prepared and could be made of such grades as would retain all the virus. He was also using Elford's collodion membranes for ultra-filtration.

Early in January 1934, I spent about a week at Harvard University in Cambridge, Mass., and attended meetings of the American Phytopathological Society.

There were weekly seminars held at Princeton on the subjects of animal and plant viruses, which I attended regularly. I also occasionally attended the seminars held in the Rockefeller Institute for Medical Research in New York on subjects pertaining to human viruses. These seminars covered a wide range of subjects pertaining to virus diseases in general and were very instructive.

Dr. L. O. Kunkel assigned to me an interesting problem on the movement of virus in leaf tissues. The results of this investigation entitled "Movement of ordinary tobacco mosaic virus in leaves of *Nicotiana sylvestris*" have been published in the October (1934) number of Indian Journal of Agricultural Science.



The glasshouse units at the Rockefeller Institute at Princeton for the investigation of virus diseases of plants are very well equipped, and are connected with the laboratories by a glass-covered passage, thus facilitating the removal of a large number of experimental plants at one time in trolleys to the laboratories for inoculation. The temperature and ventilation controls are extremely well designed, and I understood that the cost of construction of these houses amounted to more than Rs. 3,00,000. There is a large staff employed in these houses, who look after the growing of thousands of experimental plants.

I left Princeton for Wisconsin on the 18th. February 1934 after a stay of over two-months.

#### *The University of Wisconsin.*

I arrived in Madison, Wis., from Princeton on the 19th February 1934. The University of Wisconsin is one of the best known state institutions in America and has for years followed a progressive policy in matters of agricultural research. It has one of the finest situations in the country.

The Department of Plant Pathology at Wisconsin has a world-wide reputation and I utilised my visit to discuss with mycological workers in the Department many pathological problems other than those pertaining to virus diseases. I discussed with Dr. Walker and his associates our breeding policy with reference to cotton wilt in Bombay. I spoke before the Plant Pathological seminary and before a group of University professors on the organisation of agricultural research in India and on the current plant pathological research under the auspices of the Imperial Council and in the Bombay Presidency. Indeed, my brief stay at Wisconsin was full of interest.

The work on the virus diseases of plants is done in three different departments: in the Department of Botany under Dr. B. M. Duggar, in the Department of Plant Pathology, and in the Department of Horticulture under Professor James Johnson, who had until recently been engaged mainly on research in virus diseases. The facilities for research are good, although there is considerable overcrowding in the laboratories and green-houses. The research activities have been much curtailed on account of financial stringency. The following is the list of the research staff for virus work under Professor Johnson:—

Dr. Ismé Hoggan	. . . . .	General work on virus diseases.
Dr. Karl Koch	. . . . .	Potato viruses.
Mr. McMurry	. . . . .	Movement of viruses in plant-tissues.

I shall now briefly summarise the current work on plant viruses at Wisconsin:—

(1) Dr. James Johnson is at present actively engaged on a classification of plant viruses using such diagnostic characters as insect vectors, physical properties such as thermal death point and longevity, symptom expressions on differential hosts, etc. Considering the present status of our knowledge of plant viruses, the scheme worked out is fairly satisfactory, and it has been possible to classify almost half the number of known plant viruses, the other half not possible to be classified due to imperfect descriptions. The one chief merit of the proposed classification is that it lays down uniform standards for describing a virus. Dr. Johnson is conscious that a classification proposed at this stage of our knowledge will be nothing more than a tentative scheme for the identification of viruses, but he feels there is enough material available for a beginning to be made. His proposed classification is likely to invite a good deal of criticism.

(2) Dr. Karl Koch was working with yellow dwarf of potatoes, which causes yellowing of plants and necrosis in pith at nodes and growing points, and is transmitted by *Myzus persicae*. He has found that air temperatures affect the symptom expressions of the disease, air temperatures of 18° C. and below suppressing the manifestation of symptoms.

Dr. Koch had also come to very interesting conclusions as regards the X and Y viruses of K. M. Smith, and he had definitely proved the composite nature of rugose mosaic.

X of K. M. Smith	Mottle plus ring spot (mottle is common in all American potatoes, but not so ring spot).
Y of K. M. Smith	Similar to veinbanding (of Valleau and Johnson in tobacco) but not <i>exactly</i> similar: physical properties of the two virus are the same. With mottle or ring spot, Y causes more virulent spot necrosis in tobacco than veinbanding with either of these viruses.

Veinbanding produces typical rugose mosaic in Bliss Triumph (a potato variety), because mottle is latent in this variety. Rugose mosaic is thus produced by veinbanding *plus* mottle or ring spot, or veinbanding *plus* mottle and ring spot combined. But Y *plus* mottle or ring spot does not produce rugose mosaic in Bliss Triumph. Hence Y is different from veinbanding.

Further, rugose mosaic causes the lower leaves to drop and also causes rugosity and mottle of upper leaves. Y causes lower leaves to drop but upper leaves remain healthy. Veinbanding thus can be recovered from upper leaves of rugose plants, but Y cannot be recovered. Ultimately, Y appears in the upper part of the plant and finally kills it.

*Conclusions.*—Koch considers X a mixture of mottle and ring spot. Y is similar to veinbanding but not exactly alike.

As regards 'crinkle' of Murphy, Koch considered it similar to crinkle mosaic of America. He was definite that crinkle of Murphy was not rugose mosaic.

(3) Dr. Ismé Hoggan was working with the transmission of cucumber and ordinary tobacco mosaics. She has found that, from a mixture of the viruses of cucumber and tobacco mosaics in cucumber, the peach aphid will transmit cucumber mosaic virus but never the virus of ordinary tobacco mosaic. She has also found that 1 out of 300 aphids will transmit tobacco mosaic from tomato to tobacco. She has thus come to the conclusion that ordinary tobacco mosaic was not normally insect-transmitted under field conditions.

Miss Hoggan has also isolated strains of cucumber mosaic virus. She has isolated one strain of this virus, which behaves differently from the common cucumber mosaic virus in that the new strain does not age for more than two days, while the cucumber mosaic virus will age for 5 days at 70° F.

She has also shown that turnip mosaic is aphid-transmitted.

(4) Mr. McMurry was employing histological technique in tracing the path of ordinary tobacco mosaic virus in the tissues of its hosts.

(5) Dr. B. M. Duggar and his assistants were working on the separation and purification of viruses from their plant constituents.

Dr. James Johnson assigned to me a problem on "The effect of dilution on the thermal death rate of tobacco mosaic virus". The results have been published in the October (1934) number of the Indian Journal of Agricultural Science.

I left Madison on the 24th March after a brief stay of over a month.

#### *The Iowa State College of Agriculture.*

I arrived at Ames, Iowa, on the 25th March 1934 and stayed there for about three days.

I spoke before the Plant Pathological seminary on the organisation of agricultural research in India and the current mycological research in Bombay. The work on the yellow dwarf of onions and other diseases in progress was explained to me.

*The U. S. Department of Agriculture.*

I arrived in Washington, D.C., on the 20th March 1934 and stayed there for about a week.

The United States Department of Agriculture is housed in magnificent buildings in Washington, D.C. The facilities for consultation and conferences among research workers are unrivalled during the winter and spring months when a large number of scientists employed in the Department have their headquarters in Washington. There is a splendid library of the Department of Agriculture. The experimental work is done on the Arlington Experimental Farm about 3 miles from Washington, D.C.

The Arlington Experimental Farm was visited with Drs. Schultz and Raleigh, both of whom are working with potato viruses. The following is a brief summary of the important virus work in hand at the Arlington Experimental Farm.

(1) Dr. Doolittle is working with tomato (tomato streak) and cucumber viruses.

(2) Dr. McKinney is working with the green and yellow mosaic of wheat and also with the wheat rosette. Green and yellow mosaics are found west of the Mississippi and the rosette is found to the east of the river. Green and yellow mosaics are considered to be due to different viruses.

The wheat mosaic is found in Kansas and as far south as North Carolina. It will be interesting to look for wheat mosaic in the Punjab where, as in Kansas, winter wheat is grown and where climatic conditions are suitable.

Dr. McKinney was also working with corn mosaic.

(3) Dr. W. J. Zaunmeyer was working with two mosaics of peas, one of which is confined to peas only, whilst the other easily passes to beans, although it is difficult to distinguish between the two so far as symptoms are concerned. The two pea mosaics as well as the mosaics of white clover, sweet clover and red clover all pass to *Vicia faba*.

Pea mosaics must be commonly found in the north of India and doing much damage, since climatic conditions are suitable during winter and early spring.

*England.*

I sailed from New York on the 6th April, arriving in England on the 16th April 1934.

Immediately after reaching London, I saw Dr. E. J. Butler, Director, Imperial Mycological Institute, as regards arrangements to be made in connection with my visit to Egypt and the Sudan for study of wilt and leaf curl (a virus disease) in cotton, as the Indian Central Cotton Committee had made a grant for this purpose.

I visited the Rothamsted Experimental Station to see Dr. J. Henderson Smith regarding the revised plan of the proposed glass house at Poona. The revised plan was prepared in consultation with Messrs. Mackenzie and Moncur, London, and submitted to the Bombay Provincial Agricultural Research Committee in June 1934; the proposals for the glass house have been approved and forwarded to the Imperial Council for further action.

*The University of Cambridge.*

The work on plant viruses in the University of Cambridge is under the control of Dr. Salaman at the Potato Virus Research Station and deals only with the virus diseases of potatoes. Recently, however, the Rockefeller Foundation of America has made a suitable grant to the University of Cambridge for the extension of the botanical laboratories and the building of greenhouses for botanical work including virus diseases of plants, which latter work is under the control of Professor F. T. Brooks. Dr. K. M. Smith, well known for his work on potato viruses and for the first book on the virus diseases of plants, is located at the Potato Virus Research Station. Mr. Bowden is associated with Dr. Smith in his work.

I spent about a week in Cambridge looking over the virus work in progress.

*The Sudan.*

I left England on the 8th May and arrived in the Sudan on the 20th May 1934. Mr. R. E. Massey, the Government Botanist, explained to me the work on leaf curl in cotton, which has been shown to be transmittable by the white fly. The disease has not become very serious due to the non-existence of cotton and other alternate hosts of the white fly in the "dead" season in the Sudan.

I arrived in Bombay on the 8th June 1934 after an absence of about one year.

*Conclusions.*

Apart from broadening my outlook on problems related to virus diseases of plants, the present deputation has shown the need for reorganising the virus scheme in respect of one or two essential features. They are:—

(a) It is absolutely essential to make provision for an additional post of Entomologist, so that the staff would now consist of:—

*Designation.*

- |                                 |                              |
|---------------------------------|------------------------------|
| 1. Botanist . . . . .           | Assistant Plant Pathologist. |
| 2. Entomologist . . . . .       | Assistant Entomologist.      |
| 3. Graduate Assistant . . . . . | Agricultural Overseer.       |

In the Virus Research Scheme sanctioned by the Imperial Council the following provision on account of staff and establishment has been made for 5 years:—

	Rs.
1. Assistant Plant Pathologist (Rs. 300—25—400) . . . . .	21,000
2. Graduate Assistant (Rs. 150—5—200) . . . . .	9,600
3. Non-Graduate Assistant (Rs. 40—5/2—80) . . . . .	2,640
4. Clerk (Rs. 40—5/2—80) . . . . .	2,640
5. Laboratory boy at Rs. 18 per mensem . . . . .	1,080
6. Peon at Rs. 18 per mensem . . . . .	1,080
Total for 5 years . . . . .	38,040

According to the revised scales of pay of the Provincial and Subordinate services in the Bombay Presidency, the provision required for the staff and establishment will be as follows:—

	Rs.
1. Assistant Plant Pathologist—Starting at Rs. 200 per mensem in the grade of Rs. 170—10—250—15—400—20—500 . . . . .	13,200
2. Assistant Entomologist (Rs. 170—10—250—15—400—20—500) . . . . .	11,400
3. Agricultural Overseer—Starting at Rs. 118 per mensem in the grade of Rs. 110—8—150 . . . . .	8,040
4. Agricultural Sub-overseer (Rs. 35—5/2—60—E.B.—4—100) . . . . .	2,340
5. Clerk—Starting at Rs. 30 per mensem in the grade of (Rs. 25—5/2—55) . . . . .	2,040
6. Mali for glass houses (Rs. 20—1—40) . . . . .	1,320
7. Laboratory boy at Rs. 18 per mensem . . . . .	1,080
8. Peon at Rs. 18 per mensem . . . . .	1,080
Total for 5 years . . . . .	40,500

*N.B.*—If men with exceptionally good qualifications are available for the two class II posts, it will be necessary to make provision for starting one or both of them on pay higher than that shown above.

It will be seen from the above statements that the additional provision to be made on account of the staff and establishment during the five years will come to Rs. 2,460 only. Since this is urgent, I hope this will be sanctioned.

(b) *Apparatus, etc.*—I have separately submitted my proposals for a glass house at Poona to be built at a cost of Rs. 12,624, and have explained clearly why a glasshouse is an indispensable piece of equipment in modern virus research. Dr. J. Henderson Smith, the foremost authority on plant viruses in Britain, has expressed his views on this subject (*vide* Enclosure I-A to this report), and he considers these houses as essential "if one is to do work of more than the most superficial character".

#### ENCLOSURE I-A.

COPY OF LETTER FROM DR. J. HENDERSON SMITH, ROTHAMSTED EXPERIMENTAL STATION, HARPENDEN, HERTS, TO DR. W. BURNS, DIRECTOR OF AGRICULTURE, BOMBAY PRESIDENCY, POONA, INDIA.

I have had repeated consultations with Dr. B. N. Uppal, who is at present working in my laboratory here; and he has asked me to express to you my views on the subject of glass-houses in research into virus diseases of plants.

It is in my opinion quite essential in modern virus research to have adequate glasshouse accommodation, if one is to do work of more than the most superficial character. I am sure that all virus workers would be in agreement on this point. Without glasshouses one cannot control one's experiments or results.

To get the full value out of them, provision should be made in such houses (a) for insect-control, i.e., they should be insect-proof, so far as feasible; (b) for maintaining the temperature during cold weather; i.e., a source of heat to keep them up to 65° 70° F. ought to be supplied.

This, of course, adds to the cost in capital outlay and in maintenance; but the extra expense is small, in relation to the increase in efficiency obtained.

Dr. Uppal has shown me the plans of the glass-houses he suggests, and the estimated costs. Or my advice he has gone to the best firm in this country. It is important that houses of this kind be very well-made. Otherwise (as I know from my own experience) in a year or so, (owing to shrinkages, etc.), leaks and minor defects develop, and there is constant annoyance and expense. Mackenzie and Moncur are much the best firm we have for this class of scientific glasshouse. They are reliable, honest, and first-class workmen; and have had more experience than any other e.g. they have supplied such houses to Amani (Tanganyika) and Australia. The plans they have drawn for Dr. Uppal seem to me to be good plans and the cost to be reasonable. I do not think one could do better.

#### ENCLOSURE II TO ANNEXURE III.

##### THE GLASS HOUSE FOR THE VIRUS DISEASES SCHEME.

There is not the slightest need to emphasize the necessity for a glass house for the investigation into virus diseases, since all leading authorities consider an insect-proof house an indispensable piece of equipment in modern virus research. There is one matter, however, which has probably not been sufficiently explained, and this relates to the cost of building the glass house in India.

A glass house meant for use in investigations on plant viruses must possess two important features: (1) adequate ventilation for the vigorous growth of experimental plants, and (2) the complete exclusion of insects. To provide these features, a special type of construction is required, which costs more than an ordinary house. These houses have therefore to be built by firms which have had considerable experience in their construction; otherwise in a year or so, leaks and minor defects develop and there is constant annoyance and expense. As far as I am aware, no Indian firm has had the experience in making these houses, and the best British firm for this class of

scientific houses is Messrs. MacKenzie and Moncur, who have supplied such houses to Amani (Tanganyika), Australia and other parts of the Empire, where work on virus-diseases is being done. It may be possible to build these houses locally after one has been constructed, since there are many engineering features in the design of ventilators, etc., which are unknown to engineers in this country, where glass houses are very rare. After repeated consultations with virus experts and engineering firms in Britain and America, I have come to the conclusion that it will be cheaper to let Messrs. MacKenzie and Moncur build the frame work in England, which will be erected in Poona by the Agricultural Engineer to the Government of Bombay.

There is another point to which I may invite reference. It was suggested by Dr. W. McRae that we should benefit from the experience of Dr. K. C. Mehta, who has recently built small glass houses for investigations into wheat rusts. I have already pointed out that houses built locally by Dr. Mehta have been designed to serve an entirely different purpose.

The other important consideration is the cost. The estimates for a glass house placed before the Bombay Agricultural Research Committee in December last amounted to approximately Rs. 23,780. These estimates included not only the cost of the glass house but also provided for certain equipment such as blinds, soil steriliser, etc.,. However, since the Committee have decided that a further reduction in the cost must be made at all accounts, this is only possible by reducing the number of compartments from 8 to 6, with the provision that if work justified, the Committee would consider my request for the additional two compartments at a later date. With these economies, I have succeeded in reducing the cost of building a glass house in Poona to approximately Rs. 12,624, provided the glass house is built departmentally by the Agricultural Engineer to the Government of Bombay.

The following is an estimate of the cost of building the glass house in Poona :—

<i>To be obtained in England.</i>		Rs.
(1) Teakwood structure for the glass house with gauze screens, ventilation gearing, etc. (.424)	. . . . .	5,680
(2) Cast iron ventilating boles with gauze screens	. . . . .	20
(3) Customs duty on items (1) and (2) above at 25 per cent	. . . . .	1,420
 <i>To be obtained locally.</i>		
(4) Teakwood sparrd stages with cast iron uprights	. . . . .	600
(5) Complete heating apparatus	. . . . .	555
(6) Sheet glass	. . . . .	600
(7) Cost of erecting the house, including foundation, masonry, brick work, Shahabad stone paving, etc.	. . . . .	1,865
(8) Cost of potting house, including a potting table with skins, etc.	. . . . .	940
(9) Boiler house, 10' x 10' x 10'	. . . . .	250
(10) Shahabad paving in the yard for approaches, and 2-foot paving around the house (both inside and outside)	. . . . .	114
(11) Incidentals at 5 per cent.	. . . . .	600
Total	. . . . .	12,624

It may be noted that out of the total cost of Rs. 12,624 of the glass house, Rs. 5,680 will be required for expenditure in England, and the balance of Rs. 6,944 will be spent in India including the amount of Rs. 2,020 required for payment of customs duty and other incidental expenditure.

(Signed) B. N. UPPAL,  
Plant Pathologist to Government.

College of Agriculture,  
Poona, July 3, 1934.

## APPENDIX VI.

NOTE DATED THE 5TH FEBRUARY, 1935, BY THE SECRETARY IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT NO. 17:—SCHEME OF RESEARCH IN ECONOMIC ORNITHOLOGY AT A COST OF RS. 41,075 SPREAD OVER A PERIOD OF FIVE YEARS SUBMITTED BY MR. SALIM A. ALI THROUGH THE GOVERNMENT OF BOMBAY.

Attention is invited to the attached scheme of research in Economic Ornithology (Annexure I) submitted by Mr. Salim A. Ali through the Government of Bombay. The scheme involves an expenditure of Rs. 41,075 (non-recurring Rs. 2,625 and recurring Rs. 38,450) spread over a period of five years. The Bombay Government are not prepared to make any contribution to the proposed expenditure, but, if the scheme is sanctioned, the Director of Agriculture, Bombay, or any officer deputed by him will inspect the work done and submit an independent report. The views of the Imperial Entomologist on the scheme has been asked for and they will be circulated to the Advisory Board when received. (Please see Annexure II).

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

## ANNEXURE I.

## A SCHEME FOR RESEARCH IN ECONOMIC ORNITHOLOGY.

(Submitted through the Director of Agriculture, Bombay Presidency, to the Chairman, Imperial Council of Agricultural Research, Delhi).

## INTRODUCTION.

The economic importance of Birds has been little realised in India, although it is a fact that their influence is exerted in practically every branch of human activity.

Besides being a source of direct food supply to millions of human beings, wild birds stand in a class by themselves as destroyers of harmful insect pests and other vermin, and as agents in the cross-pollination of flowers\* and in the dissemination of seed.†

Economic Ornithology is the science which concerns itself with striking a precise balance between the damage caused by birds to Agriculture, Horticulture, Forestry and other human interests as against the active benefits they confer by the destruction of injurious animals and plants, and in sundry other ways. In many cases the apparent damage they do is more than compensated for by the benefits they confer in less obvious ways.

An increasing amount of attention has been paid in recent years to this science in America and Europe with excellent and far-reaching results. It is clear that in a vast agricultural country like India, where this subject has so far received practically no attention from the various provincial Agricultural Departments, properly conducted investigations into the life-histories of birds with special reference to their food and feeding habits, would prove of inestimable value.

It is suggested that under the patronage of the Imperial Council of Agricultural Research, Economic Ornithology should ultimately be made an all-India—or under the impending Reforms, a Federal—function as it is in the United States of America, because the migrations of birds in addition to their ordinary free movements, carry them to all parts of the country and the only adequate survey of their economic relations is one that takes in their entire range, regardless of subordinate political boundaries. The Provinces also, where possible, should maintain a staff for work in Economic Ornithology in the same way as they now do for Economic Botany and Economic Entomology. The work of these three departments in the Provinces should be co-ordinated and the provincial Economic Ornithologists should be affiliated to, and work in co-operation with, the Central Bureau.

\*See "Flower-Birds and Bird-Flowers in India" by Salim Ali (Journal, Bombay Natural History Society, Vol. XXXV, pp. 573-605).

†See "Hyderabad State Ornithological Survey": Introduction. By Salim Ali (J.B.N.H.S., Vol. XXXVI, pp. 364-368) and "The Role of Sub-birds and Flower peckers in the propagation and distribution of the Tree-parasite *Loranthus Longiflorus* Desr. in the Konkan" by Salim Ali (J. B. N. H. S., Vol. XXXV, pp. 145-149)

## INTRODUCTION.

It is suggested that to begin with it is desirable to continue investigations more or less on the lines of Mason and Lefroy (Agri. Dept. Memoirs, Entomol. Series iii, 1912) on the food of birds, more intensively and systematically and at different periods of the birds' lives. For this purpose certain species will be selected whose bearing on Agriculture and Forestry is more or less apparent, and their life-histories will be studied from the time of hatching to the adult state with special regard to their food and feeding habits at the various stages of their growth and at various times of the year. A census will be taken from time to time of the individuals inhabiting selected demarcated areas throughout the year, and the ecological factors governing their increase or decrease taken into account. By this means an effort will be made to estimate in quantitative terms their effect for good or evil in the areas controlled.

Side by side with the field work there will be control aviaries where the preferences of birds of particular types of food at different seasons will be studied and physiological experiments conducted to determine their reactions to different foods, and the significance of these. Experiments will also be carried out to discover the true value of birds as pollination agents and in the dispersal of plant life.

In co-operation with the Economic Entomologist, efforts will be made to determine how and to what extent the life-cycles of insect pests are intersected or controlled by the life-cycles of the birds that prey upon them.

The objection of the proposed work during the first year is mainly to convince the authorities of the importance and desirability of creating a department of Economic Ornithology to work in co-operation with those of Economic Botany and Economic Entomology. The research programme can be considerably expanded once the department is organised and in proper working order.

It must be stated at the outset, however, that research in Economic Ornithology in its early stages must necessarily be of an "academical" rather than of a practical or remunerative character. The Bureau of Biological Survey is a branch of the United States Department of Agriculture which employs at great expense a permanent staff of experts to investigate, among other things, the life-histories of birds with special reference to their economic aspect. Through their researches over many years, a great deal of information has accumulated which is now proving of inestimable value to Agriculture, Forestry and Horticulture, besides being of the greatest importance to pure Science. In an agricultural country like India the scope and usefulness of the study of Economic Ornithology are unbounded.

The locality where the proposed work would be undertaken would be decided in consultation with the Director of Agriculture, but it is suggested that some place in the neighbourhood of Poona would be suitable on account of the accessibility of Economic Botanist and Economic Entomologist for the identification of stomach contents of birds, and advice on various matters connected with their departments of work. Preferably an area would be selected which offers facilities for controlling both cultivated and forested tracts.\*

## COST OF SCHEME.

The estimated cost of working the above scheme for the first year and subsequent four years will be as shown in the attached statement.

(Signed) SALIM A. ALI.

Dehra Dun, 14th August 1934.

*Cost of 5 year Scheme for Research in Economic Ornithology*

(Submitted through the Director of Agriculture, Bombay Presidency; to the Chairman, Imperial Council of Agricultural Research, Delhi.)

*First Year—*

	Rs.
Research Officer at Rs. 420 per mensem in the grade of	
Rs. 300—20—420—E. B.—30—660—E. B.—40—	
900	5,040
Salary of one Assistant in the grade of Rs. 70—5—100	840
<i>Contingencies:—</i>	
(a) Non-recurring:	
(Microscope 375, Experimental Aviaries and Appliances 500)	875



(b) Recurring :	Rs.
(1 Chaprasi 150, Postage 120, Subscriptions to Journals, Stationery, etc., 300) . . . . .	570
Travelling Allowance . . . . .	200
<b>Total</b> . . . . .	<b>7,525</b>

*Second Year—*

Research Officer at Rs. 450 per mensem in the grade of Rs. 300—20—420—E.B.—30—660—E.B.—40—900 . . . . .	5,400
Salary of Assistant in the grade of Rs. 70—5—100 . . . . .	900
<i>Contingencies :—</i>	
(a) Non-recurring :	
(Experimental and Control Appliances and Ac- cessories) . . . . .	500
(b) Recurring :	
(Office Expense as in First Year) . . . . .	570
Travelling Allowance . . . . .	450
<b>Total</b> . . . . .	<b>7,820</b>

*Third Year—*

Research Officer at Rs. 480 per mensem in the grade of Rs. 300—20—420—E.B.—30—660—E.B.—40—900 . . . . .	5,760
Salary of Assistant in the grade of Rs. 70—5—100 . . . . .	960
<i>Contingencies :—</i>	
(a) Non-recurring :	
(Experimental and Control Appliances and Acces- sories) . . . . .	450
(b) Recurring :	
(Office Expenses as in First Year) . . . . .	570
Travelling Allowance . . . . .	450
<b>Total</b> . . . . .	<b>8,190</b>

*Fourth Year—*

Research Officer at Rs. 510 per mensem in the grade of Rs. 300—20—420—E.B.—30—660—E.B.—40—900 . . . . .	6,120
Salary of Assistant in the grade of Rs. 70—5—100 . . . . .	1,020
<i>Contingencies :—</i>	
(a) Non-recurring :	
(Experimental and Control Appliances and Ac- cessories) . . . . .	400
(b) Recurring :	
(Office Expenses as in First Year) . . . . .	570
Travelling Allowance . . . . .	450
<b>Total</b> . . . . .	<b>8,560</b>

*Fifth Year—*

Research Officer at Rs. 540 per mensem in the grade of Rs. 300—20—420—E.B.—30—660—E.B.—40—900 . . . . .	6,480
Salary of Assistant in the grade of Rs. 70—5—100 . . . . .	1,080
<i>Contingencies :—</i>	
(a) Non-recurring :	
(Experimental and Control Appliances and Ac- cessories) . . . . .	400
(b) Recurring :	
(Office Expenses as in First Year) . . . . .	570
Travelling Allowance . . . . .	450
<b>Total</b> . . . . .	<b>8,980</b>

<i>Analysis and Total.</i>	Rs.
1st Year . . . . .	7,525
2nd Year . . . . .	7,820
3rd Year . . . . .	8,190
4th Year . . . . .	8,560
5th Year . . . . .	8,980
Total Cost of Scheme . . . . .	41,075

Dehra Dun, 29th October 1934.

(Signed) SALIM A. ALI.

## ANNEXURE II.

COPY OF A REPORT BY THE IMPERIAL ENTOMOLOGIST ON THE SCHEME FOR RESEARCH IN ECONOMIC ORNITHOLOGY, RECEIVED WITH LETTER No. 519-D., OF 1935, DATED THE 16TH FEBRUARY 1935, FROM THE DIRECTOR, IMPERIAL INSTITUTE OF AGRICULTURAL RESEARCH, DELHI, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI.

In compliance with your endorsement No. 378-D, dated 7th February 1935 (not printed), forwarding a scheme of research on Economic Ornithology under consideration of the Imperial Council of Agricultural Research, I beg to report on the scheme as follows:—

2. Birds play a very important part in checking ravages of insect pests of crops. In fact next to predaceous and parasitic insects insectivorous birds constitute the most important natural checks which can keep the number of injurious insects within reasonable limits. Whereas such useful birds should be encouraged, there are, on the other hand, some birds (e.g., the Parroquets, the Bee-eaters, etc.,) which prey on beneficial insects and which therefore have to be discouraged. With the exception of a few works, no systematic attempt has so far been made in India to study the insect food of the common birds at different times of the year and in different parts of the country. Furthermore, in many cases the food of the nestling being different from that of the adult bird of the same species, the food of the various stages in the life-history of a bird has therefore to be carefully studied. Very few insectivorous birds indeed have been studied in India from this point of view. It will thus be readily recognized that economic Ornithology is an important part of economic Entomology. The object of the scheme, therefore, is commendable.

3. With regard to the qualifications of the man suitable for undertaking a study of the insectivorous birds, he must primarily be a good entomologist and in addition should possess some knowledge of birds. He should be familiar with the nature, habits and life-history of the insect fauna of the area, and be able to determine himself the stomach contents of the birds immediately after their death. Of course the knowledge of the habits of the local birds is also essential but there is comparatively sufficient literature on these aspects of birds common in the plains of India.

4. The person selected for the study of insectivorous birds should in my opinion be attached to an institution where the life-histories and biology of insect pests are being extensively studied. As far my information goes the entomological staff at the Agricultural College, Poona, is just sufficient for the teaching work in the College and has hardly any time for doing research work on insects.

5. The above remarks apply to the insect portion of the scheme only. I cannot possibly express an opinion on the value of birds as "pollination agents and in the dispersal of plant life".

## APPENDIX VI-A.

NOTE DATED THE 15TH FEBRUARY 1935, BY THE SECRETARY IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT No. 17 :—SCHEME OF RESEARCH IN ECONOMIC ORNITHOLOGY AT A COST OF RS. 41,075 SPREAD OVER A PERIOD OF FIVE YEARS SUBMITTED BY MR. SALIM A. ALI THROUGH THE GOVERNMENT OF BOMBAY.

In continuation of the note (Appendix VI) on the subject mentioned above already circulated copies of the following letters are circulated for information:—

- (1) Letter to the Director of Agriculture, Bombay, No. D-1307/34/Vet., dated the 5th February 1935. (Enclosure I).
- (2) Letter from the Director of Agriculture, Bombay, No. 493-L/1943 of 1935 dated the 13th February 1935 (Enclosure II).

## ENCLOSURE I.

COPY OF LETTER No. D.-1307/34/VET., DATED THE 5TH FEBRUARY, 1935, FROM THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, TO THE DIRECTOR OF AGRICULTURE, BOMBAY PRESIDENCY, POONA.

With reference to the enclosed copy of letter 3274/A-33, of 18th December 1934 (not printed) from the Government of Bombay and the attached printed research scheme on "Economic Ornithology", I have the honour to ask if you would kindly furnish additional information on the following points so far as available:

1. Where is the work to be done? Is the Agricultural Department providing any laboratory facilities?
2. What appointment does Mr. Salim Ali, the author of the scheme occupy? What are his qualifications for the work? How is it proposed that the Research Officer should be recruited? Has the opinion of the Forest Department in the Bombay Presidency been obtained? If so, can their recommendations be forwarded for the information of the Advisory Board?

## ENCLOSURE II.

COPY OF LETTER No. 493-L./1943 OF 1935, DATED THE 13TH FEBRUARY 1935 FROM THE DIRECTOR OF AGRICULTURE, BOMBAY PRESIDENCY, POONA, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.

SUBJECT:—Scheme for research on "Economic Ornithology".

With reference to your letter No. D.-1307/34-Vet. of 5th instant (Enclosure I) on the subject mentioned above, I have the honour to furnish the following additional information on the points referred to by you:—

1. In the first para. on page 3 of the printed scheme it has already been stated that the locality where the proposed work of the above scheme will be undertaken will be decided in consultation with me, but it has been suggested that some place in the neighbourhood of Poona may be suitable on account of the accessibility of the services of the Economic Botanist and the Professor of Entomology for the identification of stomach contents of birds etc.

Regarding the laboratory facilities to be provided by the Bombay Agricultural Department, it has been recorded in the minutes of discussion on this scheme at the last meeting of the Bombay Provincial Agricultural Research Committee held in Bombay on 19th November 1934 (Enclosure III) that, if necessary, a working place can be found for Mr. Salim Ali in the Entomological Laboratory of the Poona College of Agriculture.

2. As regards Mr. Salim Ali's qualifications for the work I am enclosing herewith the necessary copies of the testimonials received from him.

The above qualifications, I believe, will show that Mr. Salim Ali will be the right man for the research work of this scheme, and if the scheme is approved by the Imperial Council of Agricultural Research he is to be the Chief Officer who will control and guide the work.

Regarding the opinion of the Forest Department in the Bombay Presidency, I may state that I have had no occasion to consult the Head of the Department in connection with this scheme nor did any of the members of the Bombay Provincial Agricultural Research Committee consider such a reference to be necessary.

3. I may add that if you require any further information on the subject I would suggest that you address Mr. Salim Ali direct in the matter. His address has already been communicated to you in my letter No. 493-L./271 of 8th January 1935.

## ENCLOSURE III.

EXTRACT FROM THE MINUTES OF THE MEETING OF AGRICULTURAL RESEARCH COMMITTEE, HELD ON 19TH NOVEMBER 1934 AT 12 NOON IN THE SECRETARIAT, BOMBAY.

2. (3) *Economic Ornithology*.—Mr. Prater said that in 1905-07 Lefroy and Mason had published some work on Food of Birds in Bihar but that little had been done since then. Bainbrigg Fletcher's book was largely a popular account of certain birds.

The extension of crops meant the upsetting of the balance of nature and often an increase of pests. For these pests the natural check is bird life. It was necessary to know what birds were injurious and what were beneficial and to know what species to destroy and what species to encourage. Dr. Wheeler pointed out that Mr. Prater had emphasised the local importance of the scheme. He mentioned that in the Budget there was no provision for expenditure on chemicals and that the scheme as a whole was rather vague. Mr. Prater insisted that the work did affect all India and that observations carried out in one place (i.e., round Poona) would be very useful for a large area in Central and Southern India. Dr. Burns strongly supported the scheme and pointed out that it was just the type of thing which ought to be financed by the Imperial Council of Agricultural Research, as it was not likely to be normal part of the work of the Provincial Departments. Insects were most the different kind of crop pests to combat and anything that could be done towards finding and increasing the natural enemies of insects was doing. Birds were also of importance to crops in connection with the distribution of seeds of parasites such as *Loranthus* and some times in connection with the pollination of flowers and the consequent setting of seed. Professor Jhaveri said that, if necessary, a working place could be found for Mr. Salim Ali in the Entomological Laboratory of the Poona College of Agriculture.

THE COMMITTEE AGREED TO RECOMMEND THE SCHEME FOR THE  
FAVOURABLE CONSIDERATION OF THE BOARD.

True copy.

From

*The Bombay Natural History Society.—22nd June 1931.*

Mr. Salim A. Ali was till recently employed on the staff of the Bombay Natural History Society. The Society was reluctantly compelled to forego the advantage of his services owing to Government's inability to provide the special grant for maintaining him on its staff.

Previous to his official appointment, Mr. Ali spent a good many years working Wolfram Mines and Timber in the forests of Tenassarim, and later served the Society in an honorary capacity. He was appointed Assistant Curator in 1926 and in the following year Lecturer in the Prince of Wales Museum, Bombay. In the latter capacity Mr. Ali conducted Nature Study Classes for about 6,000 children attending local schools. It was due entirely to his zeal and ability that Nature Study teaching in the Museum was so successfully established and carried out. He has been invited on several occasions to Hyderabad to deliver extension lectures in Natural History before the Osmania University.

During the Curator's absence from India in 1926, Mr. Ali officiated as Curator of the Society. He carried out his duties with credit and efficiency and to the entire satisfaction of the Society's Managing Committee who placed on record their appreciation of his services. Mr. Ali served for many years as one of the Honorary Editors of the Society's Journal.

A trained zoologist and a keen and enthusiastic field naturalist, Mr. Ali has specialised in Indian Ornithology to which he has devoted many years of patient study and research. He has also had the advantage of working some time in Berlin under the distinguished ornithologist, Dr. Stresemann, who has commented very favourably on the work carried out by Mr. Ali since his return to India. His original paper on the Nesting of the Weaver Birds, published recently in the Journal of the Society, is a model of patient and successful field research. He has since published a paper on the role played by Sunbirds and Flowerpeckers in the dispersal of *Loranthus*, a plant parasite which does much damage to fruit and forest trees in various parts of India. Mr. Ali is now engaged in the study of the importance of birds in the fertilisation of flowers, a problem which has so far not been investigated in India and which has an important bearing on the forestry, arboriculture and vegetation of this country. In all this work, Mr. Ali has shown a distinct capacity and fitness for zoological field research; his work as Editor of the Society's Journal has brought him into intimate touch with various zoological problems including Game preservation; he has shown marked ability as a lecturer and the experience he has gained during his Curatorship has given him a good insight into the conduct and management of a museum.

We heartily commend him to those who may have need of his services. He comes from a distinguished Mohomedan family whose sons have served their country with distinction in various capacities.

(Sd.) P. M. D. SANDERSON, F.Z.S.,

Honorary Secretary.

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*True copy*

St. Xavier's College,

Bombay, 4th July 1931.

This is to certify that Salim A. Ali went through the Bombay University B.A. (Hons.) Course in Zoology at the St. Xavier's College during the time the Biology Department was under my charge.

Ever since then (1918) I have been in close touch with his work in natural history. The firm grounding in systematic Zoology gained by him at the College through his diligence and natural aptitude has enabled him to do creditable work both as Assistant Curator of the Bombay Natural History Society and as Guide Lecturer in Natural History at the Prince of Wales Museum, Bombay, and also in the original field researches in which he has been subsequently engaged.

He is energetic and painstaking, and I have no hesitation in recommending him for any responsible work connected with natural history (Game Preservation, Economic Zoology etc.) and feel confident of his ability to discharge his duties in an efficient and creditable manner.

(Sd.) E. BLATTER, S.J., Ph.D.

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## APPENDIX VIII

NOTE DATED THE 24TH JANUARY 1935 BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT No. 19 :—APPLICATION FROM THE GOVERNMENT OF BOMBAY FOR A GRANT OF Rs. 85,542 SPREAD OVER FIVE YEARS FOR A SCHEME OF RESEARCH IN GROUNDNUT IN THE BOMBAY PRESIDENCY, SUBMITTED BY MR., B. S. KADAM M.Sc. (CORNELL), CROP BOTANIST TO GOVERNMENT OF BOMBAY.

Attention is invited to the attached scheme (Annexure) forwarded by the Government of Bombay for research in groundnut in the Bombay Presidency. The Scheme involves a total expenditure of Rs. 85,542 viz., Rs. 12,500 non-recurring and Rs. 73,042 recurring spread over a period of five years. The local Government are not prepared to undertake any financial liability on account of the cost of the Scheme. The scheme has the approval of the Bombay Provincial Agricultural Research Committee.

2. It is proposed, subject to the approval of the Advisory Board that the Scheme should first be examined by the Indian Oil Crushing Industry Committee.

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

## ANNEXURE.

APPLICATION FROM THE GOVERNMENT OF BOMBAY FOR A GRANT OF Rs. 85,542 SPREAD OVER FIVE YEARS FOR A SCHEME OF RESEARCH IN GROUNDNUT IN THE BOMBAY PRESIDENCY, SUBMITTED BY MR. B. S. KADAM, M.Sc. (CORNELL), CROP BOTANIST TO GOVERNMENT OF BOMBAY.

## INTRODUCTION.

Groundnut, *Arachis hypogaea*, Linn, is one of the most successfully introduced crops in India. It is not definitely known when the crop was first introduced, but indications are that it began to be cultivated in India some time between the second or third decade of the last century. Groundnut as a commercial crop began to assume importance from 1870 onwards. There was a steady rise in the acreage for two decades, when, due to the ravages of disease, the acreage fell considerably. Fresh importation of seed from America and Japan in 1890 in Madras and about a decade later in Bombay, revived the acreage; since then there has been a steady rise and India to-day leads the world in groundnut production. The total area under the crop in India is nearly seven million acres; of this, Madras claims three and a half millions, Bombay, a million and a half including the Indian states, the Hyderabad state has over a million acres, Mysore state about 3 lacs and the Central Provinces and Bihar together about two lacs of acres.

With the increase in acreage the trade in groundnut has also expanded, especially during the post-war years. The pre-war average (1909-13) of export of groundnut from India was 192,000 tons. Since then the exports of this commodity have steadily increased rising to over 700,000 tons in 1931. Nearly 25 per cent. of the total produce is exported from India at present, and at the prevailing low prices, it may be estimated to be in the neighbourhood of 12 crores of rupees.

Due to the large exports the Indian trade dominates the world prices. In recent years, however, West African (Senegal) groundnut is seriously competing with the Indian produce. Another serious competitor is China, and her exports are steadily increasing. In addition to this the Indian groundnut is also losing in price as the produce marketed by other countries is comparatively more free from admixture and lower in free fatty acids than the Indian product. Due to the Ottawa agreement on foreign material there is the possibility of rise of export of groundnut to British markets from India. There is thus an urgent necessity of improving both the yielding capacity and quality of groundnut, so that India may maintain her premier position.

## IMPROVEMENT OF GROUNDNUT IN INDIA AND ABROAD.

The improvement of the groundnut crop has been achieved either by replacing the indigenous varieties by new foreign types or by the evolution of new types by breeding. The introduction of exotics has been extensively done in India, China, South Africa, the Philippines and Russia. The breeders in most of these countries are now paying attention to hybridization to improve the crop. The most extensive investigation on genetics and breeding has been done by Badami in Mysore. A new type H. G. I. with big pods and high yield has been spreading rapidly in the state. The new strain is said to be resistant to tikka (*Corcospora personata*) disease. The Department of Agriculture in the Central Provinces has evolved recently two new strains A.K. 12-24 and A.K. 10 from erect varieties. A strain Kanki. 17 was evolved in Bihar and has spread extensively. The work of improvement in Hyderabad and Madras is in progress. In Madras a special officer is in charge of the work and much useful information has been collected and spade work done in the improvement of groundnut. Breeding work at Florida and Texas in the United States has resulted in improved strains. At the former station interspecific crossing between *A. hypogaea* and *A. namtyquaræ* has been successfully done. Extensive work is in progress in Russia. In the Bombay Presidency most of the work with groundnut has been agronomic. Simple selection work at Dharwar by the cotton breeder has resulted in the isolation of a type known as No. 5 from the Spanish variety. This type is being distributed in the southern part of the Presidency. The two largest zones in the Presidency, Central and North Deccan are, however, without any improved strains. The local varieties are a mixture of many forms. They yield low and the quality of the crop is poor.

## THE PROBLEM.

Out of the 15 lacs of acres under groundnut in the Bombay Presidency including the native states nearly six lacs of acres are concentrated in East and West Khandesh and Nasik. Spanish peanut is the most extensively grown variety in this tract. Improvement of this variety requires ripening in three and half or four months, low content of free fatty acids with over 50 per cent. of oil and high yield. In the Central Deccan, comprising Ahmednagar, Poona, Sholapur and Satara, spreading varieties (Pondicherry, Big Japan and Virginia) are extensively grown. The yield of groundnut in the tract is steadily declining due to the ravages of tikka disease. The varieties besides being susceptible to tikka are a conglomeration of many forms, are low in yield and oil content. Due to the spreading nature of the varieties the cost of cultivation increases considerably. The problem is therefore to evolve types with high yield of nuts and oil, resistant to disease and clustering of pods for easy harvest. Early ripening, mid-late and late types with the above characteristics are required.

## ITEMS OF RESEARCH.

*Material.*—In addition to the collection of local samples from the various parts of Bombay and other provinces in India material from foreign countries will also be obtained. There are over 100 varieties of groundnut and as many as possible will be collected. It is essential to possess extensive material to enable one to choose desirable types for hybridization.

*Research.*—(1) Production of types with high yield; high oil content, low free fatty acid, firm pod attachment smooth surface of pods; high shelling per cent. (high ratio of nuts to shells) and clustering of pods:

(2) Evolution of early, mid-late and late types to suit different types of soil.

(3) Creation of types with disease resistance.

(4) Study of inheritance of agronomic characters such as yield, oil content, shelling per cent. maturity, kernel size, number and colour, pod attachment, corrugation and size and other obvious morphological characters. The research will form a side study along with progress of hybridization for economic purposes.

(5) Experiments in seed rate, spacing, etc., will also be conducted with the co-operation of Deputy Directors with a view to decide the most suitable seed rates and spacings for the improved strains.

(6) Agricultural classification of the existing and the new types will be made with a view to be of use to farmers.

(7) Distant crossing will be done with the object to create plant-populations to obtain new forms.

#### WORKING OF THE SCHEME.

As the problem of groundnut improvement is two-fold requiring two distinct types for the two major zones Central and North Deccan, the operations will have to be conducted at representative places. Jalgaon in East Khandesh is the most suitable place being situated in the middle of the tract. The proximity of the existing Government Farm will also be an asset in matters of mechanical help necessary in the beginning. The work for the Central Deccan will be done at Karad in the Satara District where a small sub-station will be established. Only simple selection work from the collected and hybridized material will be done at Karad. All the analytical work will be done at the main station at Jalgaon.

In the analysis of oil a standard technique will be adopted, and the new Russian method of analysing of a single or part of seed will also be tried. The latter method will facilitate extensive investigation in the breeding of types with high oil content.

The finances of the scheme are submitted separately for the Jalgaon and Karad stations. A consolidated statement is also attached.

*Statement showing approximate estimate of expenditure for the Groundnut Breeding Station at Jalgaon.*

#### I. NON-RECURRING EXPENDITURE.

	Rs.
Buildings, sheds, office, etc. (to be constructed Departmentally)	4,000
Laboratory equipment for oil analysis, etc.	2,000
Office equipment, etc.	1,000
Total	7,000

#### II. RECURRING EXPENDITURE.

	1st year.	2nd year.	3rd year.	4th year.	5th year.	Total.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
<b>A. Staff—</b>						
Breeder—						
Bombay Agricultural Service Class II (170—10—250—E.B.—15—400—E. B.—20—500).	2,040	2,160	2,280	2,400	2,520	11,400
Graduate Assistant for breeding work (70—5—100).	840	900	960	1,020	1,080	4,800
Graduate Assistant for Chemical analysis (70—5—100).	840	900	960	1,020	1,080	4,800
Typist clerk (25—5/2—55) at Rs. 30 per mensem.	360	360	420	420	480	2,040



	1st year.	2nd year.	3rd year.	4th year.	5th year.	Total.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Kamgar (35—5/2—60) .	420	420	480	480	540	2,340
2 Counters for the first year and 3 counters later on at Rs. 20—1 —30.	480	744	780	816	852	3,672
Peon at Rs. 15 per mensem.	180	180	180	180	180	900
Laboratory boy at Rs. 18 per mensem.	216	216	216	216	216	1,080
Total .	5,376	5,880	6,276	6,552	6,948	31,032
<b>B. Allowances and Honoraria—</b>						
Travelling Allowances (for breeder).	1,500	1,500	2,000	2,000	2,000	9,000
Graduates . . . . .	200	200	200	250	250	1,100
Office Establishment . .	300	300	325	350	350	1,625
Total . . . . .	2,000	2,000	2,525	2,600	2,600	11,725
<b>C. Contingencies—</b>						
Rent for 6 acres of land .	120	120	120	120	120	600
Cultivation charges . . .	1,200	1,500	1,500	1,500	1,500	7,200
Office Expenses and Mis- cellaneous.	500	600	700	700	700	3,200
Laboratory charges . . . .	800	800	800	800	800	4,000
Postage and Telegrams . .	100	75	75	75	75	400
Total . . . . .	2,720	3,095	3,195	3,195	3,195	15,400
Yearly total . . . . .	10,096	10,975	11,996	12,347	12,743	58,157
Grand total . . . . .	..	..	..	..	..	65,157

Statement showing approximate estimate of expenditure for the groundnut breeding sub-station at Karhad (District Satara).

## I NON-RECURRING EXPENDITURE.

	Rs.
Shed for office accommodation, etc. . . . .	2,000
Quarters for graduate and non-graduate staff . . . . .	3,000
Office equipment . . . . .	500
Total . . . . .	5,500

## II. RECURRING EXPENDITURE.

	1st year.	2nd year.	3rd year.	4th year.	5th year.	Total.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
<i>A. Staff—</i>						
1 Graduate (70—5—100)	840	900	960	1,020	1,080	4,800
1 Kamgar (35—5/2)—60).	420	420	480	480	540	2,340
1 Counter (20—1—30) .	240	252	264	276	288	1,320
Total .	1,500	1,572	1,704	1,776	1,908	8,460
<i>B. Allowances and Honoraria—</i>						
Travelling Allowance for graduate.	100	100	100	100	100	500
<i>C. Contingencies—</i>						
Rent for 3 acres of land .	60	60	60	60	60	300
Cultivation charges .	660	810	810	810	810	3,900
Office Expenses and Miscellaneous.	200	250	300	300	300	1,350
Postage and Telegrams .	75	75	75	75	75	375
Total .	995	1,195	1,245	1,245	1,245	5,925
Yearly total .	2,595	2,867	3,049	3,121	3,253	14,885.
Grand total .	..	..	..	..	..	20,385

*Details of estimated cost of the main Groundnut Breeding Station at Jalgaon and sub-station at Karhad, Bombay Presidency.*

I. NON-RECURRING EXPENDITURE.

	Rs.	Remarks.
Buildings, sheds, etc., for office accommodation . . . . .	6,000	It will be necessary in the interest of work if the staff has accommodation on the farm at Karhad.
Quarters for graduate and non-graduate at Karhad . . . . .	3,000	
Laboratory equipment for oil analysis, etc. . . . .	2,000	
Office equipment . . . . .	1,500	
<b>Total . . . . .</b>	<b>12,500</b>	

II. RECURRING EXPENDITURE.

	1st year.	2nd year.	3rd year.	4th year.	5th year.	Total.	Remarks.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	
<b>I. Staff—</b>							
Breeder—Bombay Agricultural Service Class II (170—10—250—E. B.—15—400—E. B. 20—500).	2,040	2,160	2,280	2,400	2,520	11,400	
3 Graduate Assistants (70—5—100).	2,520	2,700	2,880	3,060	3,240	14,400	One graduate at Karhad.
2 Kamgars (35—5/2—60).	840	840	960	960	1,080	4,680	One kamgar at Karhad.
1 Typist clerk (25—5/2—55) start on Rs. 30 per mensem.	360	360	420	420	480	2,040	
4 Counters, 3 for 1st year and 4 from 2nd year.	720	996	1,044	1,092	1,140	4,992	One counter at Karhad.
1 Peon at Rs. 15 per mensem.	180	180	180	180	180	900	
1 Laboratory boy at Rs. 18.	216	216	216	216	216	1,080	
<b>Total . . . . .</b>	6,876	7,452	7,980	8,328	8,856	39,492	
<b>B. Allowances and Honoraria—</b>							
Travelling Allowance for Officer, Graduates and Establishment.	2,100	2,100	2,625	2,700	2,700	12,225	
<b>C. Contingencies—</b>							
Rent of land for 9 acres.	180	180	180	180	180	900	About 3 acres of land will be taken at Karhad.
Cultivation charges . . . . .	1,860	2,310	2,310	2,310	2,310	11,100	
Office Expenses and Miscellaneous . . . . .	700	850	1,000	1,000	1,000	4,550	
Laboratory charges . . . . .	800	800	800	800	800	4,000	
Postage and Telegrams . . . . .	175	150	150	150	150	775	
<b>Total . . . . .</b>	3,715	4,290	4,440	4,440	4,440	21,325	
<b>Yearly total . . . . .</b>	12,691	13,842	15,045	15,468	15,996	73,042	
<b>Grand total . . . . .</b>	...	...	...	...	...	85,542	

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- Groundnuts from South and East Africa (I) Southern Rhodesia. *Bull. Imp. Inst.* 31 (2); Page 150, July 1933.
- The possibilities of groundnut as a rabi crop in the *Konkan Bombay Agric. Dept.* Leaflet No. 19 of 1929.
- Groundnut-cultivation of spanish peanuts. *Bombay Agrici, Dept.* Leaflet No. 6 of 1931.
- Cultivation of groundnut in the *Punjab Agric. Dept.* Leaflet No. 13.

## APPENDIX VIII.

NOTE DATED THE 25TH JANUARY 1935 BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT NO. 20.—APPLICATION FROM THE GOVERNMENT OF TRAVANCORE FOR A GRANT OF RS. 92,880 SPREAD OVER A PERIOD OF SIX YEARS, FOR A SCHEME ON THE INVESTIGATION OF THE "ROOT DISEASE" OF THE COCONUT PALM IN SOUTH INDIA.

Attention is invited to the attached scheme (Annexure) forwarded by the Government of Travancore for investigation of the "Root Disease" of the Coconut Palm in South India. The Scheme involves an expenditure of Rs. 92,880 spread over a period of six years.

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

## ANNEXURE.

A scheme for the investigation of the 'Root Disease' of the coconut palm in South India.

*The importance of the coconut industry.*—Coconut is a crop of very great importance especially in South India. It is a perennial which takes about ten years to come into bearing and then continues to yield profitable crops for about fifty years. The area under this crop in India has been expanding fast and is already over 13.8 lakhs. of acres. The total investment in its cultivation, even at the low rate of Rs. 500 per acre, will amount to nearly Rs. 70 crores. The average yield from an acre may be estimated at about 2,000 nuts worth nearly Rs. 40 at the present low price. Thus the annual yield from the total area of bearing palms in India will be worth not less than 5½ crores of rupees. At rates which prevailed for coconut products till recently this figure would have been over Rs. 13 crores.

Coconut is the chief money crop of the west coast of Madras. The number of people engaged in coconut cultivation runs easily into millions. Next to Agriculture, the most important occupation of the people of South West India is the manufacture of coir. This industry engaged according to the census of 1931 nearly 2½ lakhs of people. It depends entirely on the coconut palm for its raw materials. The total annual exports of coir products from Travancore alone will be worth about 1.75 crores of rupees. The taxes and rates levied on the coconut palm and its products constitute very large shares of the Revenues of the States of Travancore and Cochin and of several Districts of the Madras Presidency.

*The Root Disease.*—Of all the diseases to which the palm is subject, what is known as the "Root Disease" is the most pernicious. In India it was first reported from some villages in Central Travancore. That was about 30 years ago. The disease has been constantly under observation ever since.

It has been slowly but steadily spreading in all affected areas. It affects not only the coconut palm, but also the areca-nut and several other cultivated palms. Many of the villages in Central Travancore are already infected. The disease occurs also in Cochin. Diseases with similar symptoms have been reported from the West Indies, Mauritius, Ceylon, New Guinea and many other coconut growing countries of the world.

*Work which has so far been done in Travancore.*—There was no department of Agriculture in Travancore when the disease was first observed. The subject was therefore referred to the Conservator of Forests, who submitted a report embodying all the information he could collect. Later Dr. E. J. Butler, then Imperial Mycologist at Pusa, was requested to enquire into and report on the disease. He paid a visit of inspection, examined some specimens of diseased palms and presented a report on his findings. As his stay in Travancore was very brief, he did not carry out any experiments while here.

When a separate Department of Agriculture was constituted in Travancore, one of the first duties it set itself to was to keep this disease under control. It started work with symptomatic treatments. Regular cultivation and judicious manuring have been found to be quite effective in arresting the progress of the disease. But no cure has yet been discovered.

*Work yet to be done.*—The cause of this disease is still unknown. Experiments which have been in progress now for some years in Travancore have so far given only negative results. They have shown that some of the fungi and other organisms, which were at first suspected, are not the primary causes of this disease. The results of some of the experiments tend to indicate that the disease is perhaps physiological rather than organic in origin. Until the real cause is known, it may not be possible to devise any method of curing affected palms or preventing the spread of the disease to other palms.

*Investigation proposed.*—In view of the fact that the disease is spreading steadily though slowly, it is important to study it thoroughly and devise control measures. Research work on this disease has to be taken up on a much larger scale than was hitherto possible. The work should include a thorough microscopic and mycological examination of a large number of specimens of parts of diseased trees and of the soil in which they grow, inoculation experiments with all organisms which may be detected, studies in the physiology and nutrition of the coconut palm to ascertain the exact constitutional derangements which result in the development of the symptoms, comparative analysis of healthy and diseased parts to ascertain differences in composition, analysis of the soil to ascertain if they contain any toxins or are deficient in any of the essential elements, the search for resistant types of palms selection and breeding for disease resistance and field experiments with all remedies which may be suggested from time to time.

*Staff required.*—The present staff of the Department of Agriculture in Travancore is quite inadequate to take up this work. There is only one officer in each of the sections of the Research Branch. These officers have to attend to a number of general problems, so that it is not possible for them to concentrate their attention on this single problem. A separate staff is necessary solely to investigate this disease.

The special staff should consist of a Plant Pathologist who would be in charge of the whole investigation and two assistants, one in Botany and the other in Chemistry. They may be appointed temporarily for a period of six years in the first instance.

*Financial.*—The scheme will involve expenditure to the extent to Rs. 92,000 spread over a period of six years. The details of the same are shown in the accompanying statement.

Director of Agriculture and Fisheries.

*Statement showing details of the amount to be provided for the investigation of the "Root Disease" of the Coconut Palm.*

	1st year.	2nd year.	3rd year.	4th year.	5th year.	6th year.	
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1. Plant Pathologist (1) Salary (350—30/1—500).	4,200	4,560	4,920	5,280	5,640	6,000	
2. Assistant in Botany (1) (100—10—150).	1,200	1,320	1,440	1,560	1,680	1,800	
3. Assistant in Chemistry (1×100—10—150).	1,200	1,320	1,440	1,560	1,680	1,800	
<i>Establishment.</i>							
4. Sub-Assistants (3) Rs. 25 each.	900	900	900	900	900	900	
5. Peons (4) Rs. 10 each.	480	480	480	480	480	480	
Travelling Allowance	3,000	3,000	3,000	3,000	3,000	3,000	
<i>Contingencies.</i>							
Chemicals and Appliances (in addition to those already available).	2,000	2,000	2,000	2,000	2,000	2,000	
Wages to coolies	1,000	1,000	1,000	1,000	1,000	1,000	
<b>Total</b>	<b>13,980</b>	<b>14,580</b>	<b>15,180</b>	<b>15,780</b>	<b>16,380</b>	<b>16,980</b>	<b>92,880</b>

Trivandrum,

6th December 1934.

Director of Agriculture and Fisheries.

## APPENDIX IX.

NOTE DATED THE 24TH JANUARY 1935 BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT NO. 21.—APPLICATION FROM THE GOVERNMENT OF THE UNITED PROVINCES FOR A GRANT OF RS. 10,000 SPREAD OVER A PERIOD OF THREE YEARS FOR UNDERTAKING COTTON SEED CRUSHING AND SUPPLY OF DECORTICATED CAKE FOR EDUCATIVE PROPAGANDA.

Attention is invited to the attached scheme (Annexure) forwarded by the Government of the United Provinces for a grant of Rs. 10,000 spread over a period of three years for undertaking cotton seed crushing and the supply of decorticated cotton seed cake to provincial and State Departments of Agriculture for purposes of experiment and propaganda. The local Government agree to instal a cotton seed decorticating plant at a cost of Rs. 10,000 at the Harcourt Butler Technological Institute, Cawnpore, and also to make a recoverable advance of Rs. 10,000 for the purchase of seed. The proposed grant of Rs. 10,000 from the Council is intended to meet the probable loss on working. The scheme has the approval of the United Provinces Provincial Research Committee.

The Indian Oil Crushing Industry Committee at its meeting held in April 1933 considered the question of encouraging cotton seed oil industry in India and arrived at the conclusion that the only way to avoid the economic loss resulting from the practise of feeding uncrushed cotton seed to the livestock by the agriculturist, is to build up a demand for cotton seed cake through the agency of provincial and State Agricultural Departments. An enquiry was made from the Provincial Agricultural Departments as to how much cake would they take in the event of satisfactory arrangement being made for its supply. The replies received show that about 1,000 maunds would be required per year for experimental purposes in Government farms.

The scheme is for the consideration of the Advisory Board.

## ANNEXURE.

*Title.*—An application from the United Provinces Government to the Imperial Council of Agricultural Research for a grant of Rs. 10,000 spread over a period of three years for undertaking cotton-seed crushing and supply of decorticated cake for educative propaganda.

*Introduction.*—During the third meeting of the Indian Oil-crushing Industry Committee appointed by the Imperial Council of the Agricultural Research held in New Delhi on 4th and 5th April, 1933, the question of encouragement to be given to the cotton-seed oil industry in India was considered. It was observed that the industry was not progressing as the miller had to depend on the foreign market for the sale of this valuable feeding cake.

In India the cultivator prefers cotton-seed to cotton cake (decorticated) as a feeding stuff, though the later is one and half times more nutritious on account of higher nitrogen content than cotton-seed. A vigorous educative propaganda is therefore necessary, which along with the supply of decorticated cotton cake, may overcome this prejudice. Experiments have proved that cows fed on linseed and groundnut cake give a slightly higher yield of milk than cotton-seed cake though the quality of the milk from the cows fed on cotton cake gave richer milk.

During the last five years the export of Indian cotton-seed has gone down by 140,000 tons.

*Cotton-seed export in tons during 1927—32.*

	1927-28	1928-29	1929-30	1930-31	1931-32
Cotton-seed exported in tons.	152,952	131,313	57,818	41,350	11,655
Value in Rs.	1,44,69,976	1,32,60,277	54,87,328	22,73,807	5,95,149

This cotton-seed which used to be exported in previous years is now either used in the country for feeding purposes in addition to the quantity previously consumed for this purpose or is being wasted.

It can be seen by reference to figures of various cakes and cotton-seed that the position of decorticated cotton cakes very high so far as nitrogen and food units are concerned.

	Moisture per cent.	Proteins.	Fat.	Carbo-hydrates.	Crude fibre.	Ash.	Nutrient ratio.	Food units
Groundnut cake decorticated.	8.25	48.00	5.53	28.35	1.67	8.2	1:0.80	162
Linseed cake	11.16	29.5	9.5	35.54	9.1	5.2	1:1.94	133
Cotton-seed cake decorticated.	10.4	42.37	7.1	25.8	7.1	7.0	1:1.16	157
Cotton seed cake undecorticated.	13.75	24.6	5.56	29.3	21.2	4.6	1:1.67	107
Cotton-seed	8.00	22.4	19.2	27.4	18.9	4.1	1:2.1	131

It is highly desirable to eradicate the practice of feeding cattle with cotton seed and save the economic loss by feeding animals on the more valuable decorticated cake.

*Equipment available.*—For the supply of decorticated cake a fully equipped oil mill is necessary to undertake this experiment. There is a demonstration oil mill at the Harcourt Butler Technological Institute, United Provinces, Cawnpore, erected with an expenditure of nearly Rs. 35,000. This mill can be used for crushing cotton-seed if a cotton-seed decortivating plant is added to the equipment with an expenditure of Rs. 10,000.

*Future line of work.*—The Harcourt Butler Technological Institute, when equipped with the decortivating plant, will be in a position to provide cotton-seed decorticated cake to the Agriculture Departments of various provinces at cost price, which will be 25 per cent. higher than the cost price of the seed. The propaganda work is to be taken up by the Agriculture Departments of various provinces.

In the first year the supply of cake will be arranged up to 1,000 maunds; in the second year up to 5,000 maunds and in the third year 10,000 maunds or more.

	Moisture	Proteins	Fat	Carbo-	Crude	
Non-recurring expenditure.						
						Rs.
						Cotton-seed decortivating plant.
						Cotton seed cleaning machine . . . . .
						1,034
						Cotton seed delinter . . . . .
						2,950
						Saw blade sharpener . . . . .
						125
						Double decorticator . . . . .
						2,876
						Shaking separator . . . . .
						810
						Magnetic separator . . . . .
						91
						Elevators two . . . . .
						500
						Freight and erection . . . . .
						1,614
						Total . . . . .
						10,000



*Recurring expenditure.*—To provide against the loss in case the cake is not taken at the price 25 per cent. higher than the seed by the various provincial Agricultural Departments, the following sums of money have been included :—

	Rs.
First year 1,000 maunds cake . . . . .	1,500
Second year 5,000 maunds cake . . . . .	3,000
Third year 10,000 maunds cake . . . . .	5,500
Total . . . . .	10,000

This sum of Rs. 10,000 has been provided as an emergency measure.

In addition to this a returnable sum of Rs. 10,000 may be required for purchasing the seed, etc., for conducting these experiments. The contribution of the United Provinces Government for the scheme is subject to the vote of the Legislative Council the cost of the cotton-seed, decorticating plant (Rs. 10,000), the complete oil mill to be used for the experimental work and also Rs. 10,000 which is returnable for the purchase of seed and working costs.

*Note regarding crushing of decorticated cotton-seed.*

The percentage output of various substances obtained during manufacture are as follows :—

	Tons.
100 tons of cotton seed would yield—	
(1) Cotton oil . . . . .	12
(2) Cotton cake . . . . .	36
(3) Soap stock . . . . .	1
(4) Lint . . . . .	.72
(5) Husk . . . . .	40
Shrinkage . . . . .	10.28
Total . . . . .	100

*Income—*

	Rs.
12 tons oil at Rs. 225 per ton . . . . .	2,700
36 tons cake at Rs. 65 per ton . . . . .	2,340
1 ton soap stock } Variable factors hence not included.	
.72 ton lint }	
40 tons husk at Rs. 21.....Rs. 25 per ton . . . . .	840
10.28 shrinkage (loss)	
Total . . . . .	5,880

*Expenses—*

	Rs.
Cost of cotton-seed 100 tons at Rs. 50 per ton . . . . .	5,000
Cost of crushing decorticated cotton-seed (calculated on 12 tons of oil including cost of decortication and refining the oil) at Rs. 70 per ton . . . . .	840
Total . . . . .	5,840

The prices shown above are prices current in March 1934.

It just pays to crush cotton-seed, when the decorticated cotton-cake is sold at 25 per cent. higher price than the cotton-seed, which is quite proportionate with the food values of these articles.

## APPENDIX X.

NOTE DATED THE 26TH JANUARY 1935, BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT NO. 23.—APPLICATION FROM THE GOVERNMENT OF BOMBAY FOR A GRANT OF RS. 30,030 SPREAD OVER TWO YEARS FOR A SCHEME FOR RESEARCH IN AGRICULTURAL ECONOMICS BY THE DIRECTOR, GOKHALE INSTITUTE OF POLITICS AND ECONOMICS.

Attention is invited to the attached extract from the letter (Annexure I) from the Government of Bombay, No. 2872-A./33, dated the 12th November 1934 forwarding the application mentioned above. The scheme (Annexure II) involves so far as the Council is concerned, a total expenditure of Rs. 30,030 spread over two years, but it will be seen from the Bombay Government letter referred to above that both the Provincial Agricultural Research Committee and the Government of Bombay have approved only the portion dealing with farm management survey at a cost of Rs. 15,000 spread over two years.

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

## ANNEXURE I.

EXTRACT FROM LETTER No. 2872-A./33, DATED THE 12TH NOVEMBER 1934, FROM THE SECRETARY TO THE GOVERNMENT OF BOMBAY, REVENUE DEPARTMENT, BOMBAY CASTLE.

I am directed by the Government of Bombay (Transferred Depts.) to forward the following five schemes for grants-in-aid from the funds of the I. C. A. R.—

- \* \* \* \* \*
- (5) Scheme for research in agricultural economics by the Director, Gokhale Institute of Politics and Economics. (Annexure II.)

I am to state that the first four schemes were approved by the Provincial Agricultural Research Committee at a meeting held on 20th July 1934. The Government of Bombay recommend these schemes for the favourable consideration of the Imperial Council of Agricultural Research.

2. As regards the last scheme, I am to state that it consists of two parts, viz., Farm Management Survey and Marketing Survey. The scheme was examined by the Provincial Agricultural Research Committee. The Committee approved the portion of the scheme dealing with farm management survey involving a cost of Rs. 15,000. The Government of Bombay support the Committee's recommendation on the point.

3. I am to add that the Government of Bombay will not be prepared to undertake any financial liability on account of the cost of any of the five schemes mentioned above.

\* \* \* \* \*

## ANNEXURE II.

## SCHEME FOR RESEARCH IN AGRICULTURAL ECONOMICS.

*Dated 28th April 1934.*

From

D. R. GADGIL, M.A., M.Litt. (Cantab.),  
The Director, Gokhale Institute of Politics and Economics,

Poona 4.

To

THE SECRETARY,  
Imperial Council of Agricultural Research,  
New Delhi.

Dear Sir,

I have the honour to submit herewith, on behalf of the Gokhale Institute of Politics and Economics, an application for grant in aid of research in agricultural economics as outlined below.

## STANDING OF THE INSTITUTE.

Before we proceed to give the details of the schemes we would like to state briefly the standing of this Institute as an agency for undertaking such research work. As will be seen from the accompanying leaflet (Annexure III) in which a brief account of the Institute since its establishment, in June 1930 has been given. Mr. D. R. Gadgil, M.A., M.Litt. (Cantab.), the Director of this Institute, has been recognised by the Bombay University as a teacher for post-graduate instruction and research in economics. Besides post-graduate instruction, the Institute is being gradually developed as a nucleus for the study and investigation of specific economic problems.

Although our attention is not restricted to agricultural problems alone, they will always form one of the special and important features of our economic research. As remarked by the Committee on Agricultural Economics appointed by the Empire Marketing Board in their report (E.M.B.1, 1927) "economic research has to have a technique of its own and its observations have got to be continuous to make them of some value." The appreciation of this need has been shown by the rapid growth in the last two decades in many countries, of agricultural economic research stations. The Royal Commission on Agriculture in India have recommended "the establishment of a Bureau of Agricultural Economic Research in each of the Provinces." (Recommendation 27.) The Board of Agriculture in India in their meeting held on 9th December 1929, has endorsed the above recommendation of the Royal Commission and have emphasised, "the need of whole-time investigators for economic enquiries, as it is impossible for agricultural assistants to carry out those investigations in addition to their ordinary duties," (Resolution II.) We have to point out in this connection that this Institute has appointed, since August 1931, a whole-time investigator for carrying out agricultural economic enquiries. Mr. B. C. Burt, the Agricultural Expert to the Imperial Council of Agricultural Research, has remarked while moving the above resolution at the Board's meeting that, he preferred that, "the primary investigator should be an agricultural assistant or a graduate from an Agricultural College, as it is necessary to get the confidence of the cultivators before he will give any information." We are glad to mention on this point that Mr. V. R. Gadgil, who has been in charge of our investigation in agricultural economics, is a B.Ag. of the Bombay University and an M.Sc., of the University of California; and as regards his ability for conducting the investigation and winning the confidence of the cultivators, it may be judged from the report of the "Survey of the Marketing of Fruit in Poona", copies of which have been sent to the office of the Imperial Council in November last.

The subject of Agricultural economics has many phases of which (i) Marketing Research and (ii) Farm Management Research, are the two in which the Institute has interested itself for the present.

*(i) Marketing Research.*

We need not dilate here on the importance of Marketing Research. It has been increasingly recognised almost all over the world especially during the last two decades. The Royal Commission on Agriculture in India has also recommended the conduct of detailed marketing surveys. The institute has recently carried out a survey of the marketing of fruit and contemplates undertaking similar marketing surveys with reference to other farm products, such as vegetables (potatoes and onions in particular), groundnut, tobacco, chillies and other money crops. The study of the marketing of potatoes and of groundnut are, if funds permit, immediately under our contemplation.

*(ii) Farm Management Research.*

Farm Management Research is the other phase of economic research which has particularly attracted the attention of this Institute. "The chief object of this branch of research is to point out concrete improvements in farm organisation by analysing the individual farm or by analysing the general conditions of many farms of the same kind." J. P. Maxton of the Agricultural Economic Institute, Oxford, in his memorandum (E.M.B.1, 1929) on behalf of the Agricultural Economics Committee has also remarked in this connection that studies in farm economics of this kind, "can help each farmer individually to improve the economic organisation of his farm and at the same time provide a foundation upon which agricultural policies may be built." The two principal methods of Farm Management Research are:—(A) Cost accounts and (B) The survey method. We need not go here into any detailed discussion of the two

methods. Both the methods are valuable in their own way in the study of farm management problems. The method of costing aims at examining each farm in as great detail as possible; but being expensive, only a comparatively few farms can be costed.

#### THE SURVEY METHOD.

The advantages of the survey method on the other hand are "speed, cheapness and a much more comprehensive picture of economic conditions of farming" as summed up by Maxton. "In a space of a few months" as he further says "a large number of survey records can be obtained, sufficient to form the sound basis of a description of farming conditions and to yield records for analysis, in the first year of working."

This method has been used extensively in the United States where over 70,000 farms had been surveyed by this method by the year 1925. It has been used by the Agricultural Economics Research Institute at Oxford where 1,500 farms or over were surveyed during a period of five years (1922 to 1927). It has similarly been used by the Farm Economics Branch of the Department of Agriculture of the University of Cambridge. The Department of Agriculture for Scotland has also recently published the report on the financial results obtained on certain groups of farms in Scotland in 1928-29. The Ontario Agricultural College (in Canada), the Agricultural College of British Columbia, the Departments of Farm Economics of South Africa and New Zealand and Agricultural Economic Research Stations in several other countries are now freely using this method. In short, this method has now become practically established all over the world. It has, however, not yet been used for this purpose in India. The main object achieved by these surveys is to determine the profitability of farming in particular tracts and to isolate the different factors that contribute towards efficiency in farm management.

#### THE PROPOSED FARM MANAGEMENT SURVEY.

It is the survey method, therefore, which we intend to use in the Farm Management Research we are going to undertake. As an experiment in this direction we have in view for immediate work the survey of a large number of farms in the potato tract of the Khed Taluka in the Poona District. We have already conducted certain preliminary investigation and have now prepared a tentative schedule of forms to be filled in on each farm by our field workers during the course of the investigation. It covers all the main features of the whole farm business for the period of one year. This schedule may be modified according to information that may be required in the case of other tracts or other types of farming.

#### EXTENT OF THE APPLICATION OF LOCAL SURVEYS.

The question of the applicability of such local surveys is best answered by Maxton in the following words:—"It must be noted that the survey method aims at limiting each study to a comparatively small area, within which the conditions are reasonably uniform and it having the data and analysis complete for that area. Extension of the survey method over a wider and diverse area and ultimately over the country as a whole, is to be sought by multiplication of surveys rather than by extension of one survey over the wider area". It is essential, therefore, that Farm Management Surveys of the type mentioned above should be conducted for different types of farming in various parts of India. It is not, however, within the scope of work of any one Institution or Department alone; and it also means provision of sufficient funds for carrying out such surveys. What an Institute like ours can think of doing within the scope of the funds at our disposal at present is merely pioneering work in the introduction and working out of methods of research.

#### FUNDS.

The research work that has been going on at the Institute has been made possible by the donation to the Servants of India Society by Rao Bahadur R. R. Kale, M.L.C., of Satara, the interest of which is to be used for employing research workers. The extent and the speed of our research work is limited for the present to the above source of income, and its development is severely hampered by lack of more funds.

It is, therefore, that we approach the Council with a request for grants for research work along the two lines of research mentioned above, namely, (i) Marketing Surveys and (ii) Farm Management Surveys. We attach herewith an estimate of two yearly grant of Rs. 15,000 for each of the two schemes.

#### ESTIMATE.

The estimate that we have submitted in each case is almost on a rockbottom level of costs. The basis of salaries on which our staff works, is almost the same as in the case of the life-members of several public institutions in Poona such as the Servants of India Society, the Deccan Education Society, etc. It will be noted, therefore, that we are in a position to offer the above estimates at a lower level of costs only because it is proposed to carry out the research schemes institutionally.

#### ADVISORY AND ORGANISATION WORK.

Before we close we would like to make a mention of some important work other than pure research which the Institute proposes to undertake. It will be of an advisory nature and closely allied with our work of investigation. It will be mainly concerned with financial accounts of farms, their keeping and interpretation and with advisory and organisation work in connection with the marketing of farm produce.

As regards the practice of keeping accounts, it is more an exception than a rule in the case of Indian farmers. For their own benefit, as well as for the purpose of facilitating the work of the survey method, it is advisable that farmers should be induced and encouraged as in the United States, to keep at least simple financial accounts. Projects to organise Farmers' Book-keeping Societies, or Farm Accounting Associations on a co-operative basis (where the accounts are written by clerks employed by the associations), as are found in some parts of Europe, e.g., Germany, Switzerland and Denmark, would, we believe, be well-worth-trying in this country.

Hoping that our application will be favourably considered by the Council.

(Through the Bombay Provincial Agricultural Committee.)

#### *Two years' Budget Estimate for a Farm Management Survey.*

	1st year.	2nd year.
	Rs.	Rs.
* Directing and conducting the investigation . . . . .	3,000	3,000
Assistant Investigator at Rs. 60 per mensem . . . . .	720	720
Clerk at Rs. 30 per mensem . . . . .	360	360
Fieldmen (2) at Rs. 30 per mensem . . . . .	720	720
Peon at Rs. 20 per mensem . . . . .	240	240
Travelling allowances for the Investigator . . . . .	720	360
Travelling allowances for the Assistant Investigator . . . . .	360	240
Travelling expenses of the two Fieldmen . . . . .	360	180
Remuneration to cultivators . . . . .	500	....
Remuneration for local help in villages . . . . .	250	250
Printing of forms, leaflets, etc. . . . .	200	....
Stationery and postage . . . . .	200	100

\* This represents a part of the Director's and Chief Investigator's salaries.

	1st year.	2nd year
	Rs.	Rs.
Books, bulletins, periodicals, etc. . . . .	300	200
Publication of the report . . . . .	....	600
Miscellaneous . . . . .	50	50
	7,980	7,020
Total for two years . . . . .	15,000	

*Two years' budget estimate for a Marketing Survey.*

	1st year.	2nd year.
	Rs.	Rs.
* Directing and conducting the investi- gation . . . . .	3,000	3,000
Assistant Investigator at Rs. 60 per mensem . . . . .	720	720
Clerk at Rs. 30 per mensem . . . . .	360	360
Fieldman at Rs. 30 per mensem . . . . .	360	360
Peon at Rs. 20 per mensem . . . . .	240	240
Travelling allowances for the Investigator . . . . .	1,000	500
Travelling allowances for the Assistant Investigator . . . . .	500	250
Travelling allowances for the Fieldman . . . . .	180	90
Remuneration for local help at different centres . . . . .	500	250
Printing of forms, leaflets, etc . . . . .	200	....
Stationery and postage . . . . .	200	100
Books, bulletins and periodicals, etc. . . . .	300	200
Publication of the report . . . . .	....	600
Contingencies. . . . .	400	400
	7,960	7,070
Total for two years . . . . .	15,030	

ANNEXURE III.

THE GOKHALE INSTITUTE OF POLITICS AND ECONOMICS.

The Institute was founded on 12th June 1930 on the occasion of the 25th Anniversary of the Servants of India Society at the Headquarters of the Society at Poona. One of the main aims of the late Mr. Gokhale in founding the Servants of India Society was to provide for a thorough study of the political and economic problems of India and one of the objects towards which the Society's members are expected to direct

\* This represents a part of the Director's and Investigator's salaries.

their efforts is "organizing the work of political education and agitation, basing it on a careful study of public questions." With this end in view Mr. Gokhale was at great pains to get together a well-equipped library and this has been kept abreast of the times by regular additions subsequently. It had all along been felt that the utility of the library would be greatly enhanced, the general work of the Society largely helped and the aims of the founder of the Society more fully realised if some wholetime academic workers could be associated with the Society for the detailed and continuous study of India's economic and political problems. This long desired extension of the Society's activities was made possible by a munificent donation of over a lakh of rupees to the Society by Rao Bahadur R. R. Kale, M.L.C., of Satara, to form the corpus of a fund, the interest of which is to be used by the Society for the purpose of employing research workers. A nucleus has thus been formed of an institution which, with the help of other donors, may in future develop into a full-fledged Institute of Politics and Economics. It has been decided in the beginning to open only the Economics branch of the Institute.

The object of the Institute is to conduct studies of the various economic and political problems of India and to train workers for the conduct of such study. The staff of the Institute undertake research work and carry out detailed investigations in specific economic and political problems and its members will willingly afford guidance to other research workers who seek their help. More particularly, it is the aim of the Institute to help in the study of problems the practical solution of which is being attempted by our public workers—especially those connected with the Servants of India Society. The Institute will, it is expected, be able to secure the co-operation of other workers and associations in Poona and outside, in the carrying out of these objects.

The Institute has hitherto published two brochures: (i) The Salaries of Public Officials in India, (ii) Imperial Preference for India. Both of these were written by Mr. D. R. Gadgil and priced at Re. 1 each. The second publication is now, however, out of print. The Institute has undertaken detailed investigation of two important problems. The first investigation, that on the marketing of fruit in Poona has been completed and a report embodying the results of this investigation will be published very shortly. The other investigation concerning the economics of road transport in the Bombay Deccan is at present being carried out.

Apart from the main research activities of the Institute it was felt that the utility of the Institute would be enhanced if it were made a centre of post-graduate instruction for students preparing themselves for the M.A. degree examination of the Bombay University. An application having been made to the University for this purpose the Director of the Institute, Mr. D. R. Gadgil, was recognised by that body as a post-graduate teacher and now the Institute participates in the inter collegiate system of M.A., lectures in Poona in the History Branch. Students admitted to the Institute can thus keep terms and appear at the M.A. Examination of the Bombay University. Those desirous of submitting a thesis for the M.A. degree are also admitted to the Institute. Only students intending to prepare a thesis in the Economics group are admitted and all such students must personally interview the Director previous to obtaining admission.

Every student who intends to appear at the M.A. Examination has to register his name as a post-graduate student at the office of the University Registrar within one month of the date of the commencement of the academic year in which he begins his studies. The registration fee is Rs. 5. All candidates appearing for the M.A. degree examination must have worked under a recognised post-graduate teacher for a period of two years. The academic year begins in June and consists of two terms. The first begins on the first Saturday after June 14 and ends on the first Friday after October 6. The second term begins on the first Saturday after November 4, and ends on the first Friday after March 6. Those who have obtained the B.A. degree of the Bombay University are eligible for admission to the M.A. classes. A Bachelor of Arts of another University seeking admission to the M.A. classes shall apply to the Registrar, Bombay University, with a fee of Rs. 20 for a certificate of eligibility. A fee of Rs. 30 per term is charged to students of the Institute.

The library of the Servants of India Society is available to students of the Institute for reading and reference. It is open for reference even on Sundays.

Two scholarships of Rs. 25 per mensem are granted by the Institute to post-graduate research students. The need for endowments for more such scholarships is specially keenly felt.

The Institute admits and the Institute staff is willing to help students other than those admitted to the M.A. classes. Those wishing to be so admitted or wanting to take advantage of the facilities afforded by the Institute temporarily or casually should write or see the Director personally.

A few rooms for students and research workers are available in the Society's Home.

As part of its extra-mural activities the Institute has recently begun to arrange from time to time for lectures on important economic topics of the day in the city.

Staff—

*Director.*—D. R. GADGIL, M.A., M.Litt. (Cantab.),

*Investigators.*—V. R. GADGIL, B.Ag. (Bom.), M.Sc. (Calif.),

L. V. GOGATE, B.S. (N. Carolina).

*Publications of this Institute.*

*Publication No. 1.*—The Salaries of Public Officials in India by D. R. Gadgil, M.A., M.Litt. (Cantab.).

*Publication No. 2.*—Imperial Preference for India (The Ottawa Agreement Examined) by D. R. Gadgil, M.A., M.Litt. (Cantab.).

*Publication No. 3.*—A survey of the Marketing of Fruit in Poona by D. R. Gadgil, M.A., M.Litt. (Cantab.), and V. R. Gadgil, B.Ag. (Bom.), M.Sc. (Calif.).

*Publication No. 4.*—Motor Transport in some Districts of the Bombay Presidency. (In preparation.)



## APPENDIX XI.

NOTE DATED THE 4TH JANUARY 1935, BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT No. 28 : APPLICATION FROM THE GOVERNMENT OF BARODA FOR A GRANT OF Rs. 12,000 SPREAD OVER A PERIOD OF THREE YEARS FOR A SCHEME FOR RESEARCH ON (i) THE PRESERVATION OF MAHURA FLOWERS AND (ii) THE MANURIAL VALUE OF SPENT FLOWERS.

Attention is invited to the attached scheme (Annexure) for research on (a) the preservation of Mahura flowers and (b) the manurial value of spent flowers from the Chemistry Department of the Baroda College. The scheme, which has been approved by the Government of Baroda and the Research Committee of the State, involves a non-recurring expenditure of Rs. 2,840 and recurring expenditure of Rs. 9,060 or a total expenditure of Rs. 12,000 spread over a period of three years.

The scheme is for the consideration of the Advisory Board.

## ANNEXURE.

A SCHEME FOR RESEARCH ON (A) THE PRESERVATION OF MAHURA FLOWERS, AND (B) THE MANURIAL VALUE OF SPENT FLOWERS.

*Introduction.*

Mahura tree (*Bassia Latifolia*) is indigenous and widely spread in the Baroda State, in the Districts of Kaira, Panch Mahal, etc., in the Presidency of Bombay, in the Hyderabad State and in Central India. In South India and Ceylon its place is taken by *Bassia Longifolia* and is put to the same use.

The flowers of the Mahura tree are highly rich in sugar and are highly valued as food-stuff. About thirty years ago nearly a million people in Central India used corolla of the flowers as article of food, each person consuming about 80 lbs. per annum. In the Bombay Presidency, these flowers are also used for domestic consumption, and are looked up as a valuable reserve of food in famine years.

At present the greater portion of the crop of flowers is used for the preparation of country-wines, the manufacture of methylated and rectified spirit, which is used in Pharmaceautical preparations and perfumery.

During the war acetone required in connection with the manufacture of munitions was manufactured by a fermentation process from the Mahura flowers. It was reported that the yield of acetone from Mahura flowers was ten times as much as obtainable by distilling wood. Though the demand for acetone in India may not justify the use of these flowers for the manufacture of acetone; in view of the increased attention to, and some of the successful demonstrations on, the use of alcohol for power purposes, the *Bassia* flowers may be looked upon as a cheap source for the manufacture of industrial alcohol, since the yield of alcohol is relatively higher than from any other material commonly used for the manufacture of alcohol.

In the Baroda State and also in the Presidency of Bombay, Mahura flowers are the chief source for the manufacture of country liquors, and spirits. The consumption of flowers for distillation purposes in the State and the Presidency may be taken at about 5,00,000 Bengal maunds per annum.

The Mahura tree begins to flower in the months of March and April when the ground beneath the tree is cleared for collecting the flowers. The corollas of the flowers fall to the ground in the early hours of the morning and are collected by women and children. They are then dried in the sun till they develop a brownish red colour. A tree yields about 200 to 300 lbs. fetching from 3 to 6 rupees. The fresh flowers are very sweet with a pungent flavour and characteristic odour. They resemble figs in flavour and are eaten either fresh, or dry or cooked. The flowers are more or less a rotary crop, collected in abundance once in every two years. When stocked in the godown they get deep brown in colour and form into wet lumps. In consequence of storage the fermentable sugar partly gets caramelised to a difficultly fermentable sugar. The yield of alcohol, consequently, falls by about 25% in a year's time and further by 33% by the end of the second year. It will thus be seen that as a result of storage of flowers, as has to be done, there is a considerable loss to the distillers and to the Government as well, by way of loss in excise duty. In view of the above, the distillers cannot afford to pay reasonable prices to the agriculturists. The following would give an idea of the loss on this account to the distillers and to the Government :—One maund of flowers, when they are fresh, yield about 4 gallons of

proof spirit or 2.4 gallons of rectified spirit, which however, when the flowers are stored for long time drops to about 2.4 gallons of proof spirit or 1.4 gallons of rectified spirit. Assuming about 1,00,000 Bengal maunds of flowers being required to be preserved for over a period of two years the loss will amount to about 1,50,000 gallons of proof spirit alone to the Presidency of Bombay and the Baroda State.

It seems that this heavy loss could be avoided by investigating into the conditions which bring about this drop in the fermentable sugar content of the Bassia flowers as a result of storage, by finding out the ideal conditions under which the flowers could be stored over a period upto two years or more without deterioration.

The spent flowers are a source of anxiety to all distillers as regards their disposal, in consequence of the foul smell they give on fermentation. The same may be said about the spent wash. The spent flowers contain cellulose and albuminous matter. The spent wash contains potash salts and albuminous matter. As such, both appear to possess large manurial value and in fact small experiment by way of manuring potato and tobacco plants have indicated very promising results. The crops improve both in quality and quantity.

It will thus be seen that the Mahura flowers can be put to use with economic advantage to the agriculturists, the industrialists and the Governments, if this scheme for research is undertaken.

## THE SCHEME.

### (A) PRESERVATION OF FLOWERS.

(1) The main factors responsible for the deterioration of the fermentable sugars in the Mahura flowers may be either one or more of the following :—

(i) Moisture content of the flowers, (ii) temperatures attained in the godowns and (iii) bacterial action.

Effects of each of the above mentioned factors will have to be investigated.

### (B) MANURIAL VALUE OF THE SPENT FLOWERS.

The flowers will have to be subjected to the qualitative and quantitative chemical analysis and on the basis of these analysis their manurial value will be determined by employing them as manures (i) directly as obtained from the distilleries and (ii) in conjunction with artificial manures.

These investigations will be carried out at the Golden Jubilee Science Institute of the Baroda College under the guidance of Dr. K. G. Naik, M.A., D.Sc., F.I.C., Director of the Chemical Laboratories and Dr. M. D. Avasare B.A., M.Sc., Ph. D., Professor of Chemistry. The Government of Baroda will meet all the ordinary laboratory requirements such as common glassware, chemicals, etc., obtainable at the Golden Jubilee Science Institute. The Agricultural Department will provide facilities for the manurial work, and the Alembic Chemical Works which use Mahura flowers on a large scale will supply the raw materials. The Imperial Council of Agricultural Research is approached for an extra grant of about 12,000 rupees, spread over a period of three years to meet the cost of special staff and apparatus as detailed below :—

#### *Recurring Expenditure.*

	1st year.	2nd year.	3rd year.	Total
	Rs.	Rs.	Rs.	Rs.
(1) Assistant Chemist 200—20/1— —300 . . . . .	2,400	2,640	2,880	7,920
(2) Laboratory boy Rs. 15 p. m. . . . .	180	180	180	540
(3) Travelling . . . . .	200	200	200	600
				<u>9,060</u>

*Non recurring.*

	<i>£ s. d.</i>	
(1) Oven . . . . .	27 0 0	
(2) Hygrometer . . . . .	3 10 0	
(3) Constant Temperature and Humidity oven . . . . .	45 0 0	
(4) Microscope . . . . .	30 0 0	
Total . . . . .	105 10 0	
about 40 per cent. freight, duty, at . . . . .	42 4 0	
Total . . . . .	147 14 0	Approx. Rs. 2,000-
(5) Erection of special chambers for storage . . . . .		Rs. 840
Grand total		Rs. 12,000

M. D. AVASARE,  
*Professor of Chemistry.*

## APPENDIX XII.

NOTE, DATED THE 31ST JANUARY 1935, BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT No. 29 :—AGRICULTURAL MARKETING.

Since the last meeting of the Advisory Board the following steps have been taken in regard to agricultural marketing :—

- (1) The Government of India by Resolution No. F.-16-M.-34, dated 10th January 1935 (not printed) have constituted a new attached office of the Imperial Council of Agricultural Research Department for the Central Marketing Staff (consisting of 3 Senior Marketing Officers, 3 Marketing Officers and 12 Assistant Marketing Officers) under the Marketing Experts to the Council who will in future be Agricultural Marketing Adviser to the Government of India. The office of the Agricultural Marketing Adviser will be located at the Temporary Secretariat, Old Delhi. The marketing officers have all been appointed and have reported for duty. The scope of the work is outlined in the Government of India Resolution already referred to.
- (2) Subject to funds being voted by the Legislative Assembly a grant on account of provincial marketing staffs amounting to a total of 2 lakhs per annum is being placed at the disposal of the Imperial Council of Agricultural Research for a period of about 5 years.
- (3) Proposals having been submitted by the various local governments were subsequently modified in the light of the recommendations passed at the last meeting of the Advisory Board. Except in the case of North-West Frontier Province where the final forms of the scheme is not as yet fixed, each Province is now prepared to place a Senior Officer in charge of marketing work and the Governing Body has sanctioned schemes in all the provinces (including Sind) for the appointment of Assistant Marketing Officers to the extent of Rs. 20,000 per annum in each of the provinces other than Assam and North-West Frontier Province where the Governing Body adhered to the maximum figure of Rs. 10,000 as recommended by the Advisory Board.
- (4) Replies have been received from 125 Indian States promising co-operation to the extent at least of nominating one person to deal with marketing in the State and 18 of these States are taking steps to appoint their own marketing staff. The Governing Body have held over for further consideration the question of grants to constituent Indian States.

## APPENDIX XIII.

NOTE, DATED THE DECEMBER 1934, BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT No. 31 :—APPLICATION FROM THE ANDHRA UNIVERSITY FOR A GRANT OF Rs. 1,000 FOR A SCHEME TO FIND OUT THE BEST METHOD OF EXTRACTING NICOTINE COMMERCIALY FROM TOBACCO WASTE AND TO DESIGN AN APPARATUS FOR THE SAME.

Reference is invited to the note, dated the 26th May 1934 (Annexure I) circulated to the Advisory Board on the above subject, at its meeting held in September 1934. The application was first examined by the Tobacco Sub-Committee of the Board, and on being informed that some experimental work on the lines proposed was being carried out by the Industrial Chemist, Bombay, the Sub-Committee recommended that the Industries Department, Bombay should be requested to supply any information available and that the application should be further considered at a future meeting. This recommendation was accepted by the Advisory Board.

2. The attached letter No. I.B.-150/8589, dated the 13th October 1934, from the Director of Industries, Bombay (Annexure II) contains the information collected from the Government of Bombay. The subject is for the consideration of the Advisory Board.

## ANNEXURE I.

IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ADVISORY BOARD,  
TENTH MEETING, SEPTEMBER, 1934.

SUBJECT No. 35.

APPLICATION FROM THE ANDHRA UNIVERSITY FOR A GRANT OF  
RS. 1,000 FOR A SCHEME TO FIND OUT THE BEST METHOD OF  
EXTRACTING NICOTINE COMMERCIALY FROM TOBACCO WASTE  
AND TO DESIGN AN APPARATUS FOR THE SAME.

Attention is invited to the attached letter from the Government of Madras, No. 446-Ms., dated the 4th April 1934 (Appendix), forwarding *inter alia* the scheme mentioned above. The scheme which involves an expenditure of Rs. 1,000 is now for the consideration of the Advisory Board.

CHARAN DAS,  
Secretary.

The 26th May 1934.

## APPENDIX.

COPY OF A LETTER FROM THE GOVERNMENT OF MADRAS, DEVELOPMENT DEPARTMENT, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 446-Ms., DATED THE 4TH APRIL 1934.

## ANDHRA UNIVERSITY SCHEMES.

I am directed to forward the following schemes submitted by the Registrar, Andhra University, Waltair, for financial assistance from the Council:—

- |      |   |   |   |   |   |
|------|---|---|---|---|---|
| 1. * | * | * | * | * | * |
| 2. * | * | * | * | * | * |

3. Technology of tobacco waste.

(2) The schemes were circulated to the members of the Provincial Research Committee. The first scheme has been recommended by four members, the second by three and the third by six including the Director of Agriculture. In the opinion of the Local Government, however, none of the schemes are deserving of financial aid from the Council.

*III. A scheme by Dr. N. R. Damle, M.Sc., Ph.D., Lecturer in Chemical Technology, Jeypore Vikrama Deo College of Science and Technology, Waltair, for a grant from the Imperial Council of Agricultural Research.*

## TECHNOLOGY OF TOBACCO WASTE.

There is available large amount of tobacco waste in Guntur district and adjoining districts in the Andhra country. It is possible to extract from it "Nicotine" which is a valuable material greatly in demand for spraying on fruit trees as an insecticide. It is contemplated to do some work on the subject, to find out the best method of extracting nicotine commercially and to design an apparatus for the same. A semi-large scale plant to deal with about 100 lbs. of tobacco waste at a time would be built in the department in order to be able to get complete data on the subject.

The expenses required for carrying on the above work would be about Rs. 1,000.

## QUALIFICATIONS, ETC., OF THE APPLICANT.

1. Passed in 1921 the B.Sc., of the University of Bombay with distinction with Chemistry and Physics—obtained the rank of first in first class.

2. Joined the Indian Institute of Science as Bombay Government Scholar for the study of the Chemistry and Technology of oils and fats under Dr. Sudborough. After undergoing a thorough grounding in the various technical subjects such as refining, hydrogenation and hydrolysis of the oils and fats, was engaged in the following problems for research. The papers embodying the results have now been published in the Institute Journal:

- (1) Constitution of rape oil (Jour, Ind. Inst. of Science 9-A, Part II, p. 26).
- (2) Oil from *Tropeolum majus* seeds—*Ibid* p. 65.
- (3) The preparation of pure behenic acid.
- (4) Solidifying point curves of mixture of several fatty acids and esters.

Was awarded the A.I.E.Sc. of the Institute and the M.Sc. of the University of Bombay in 1924 for the thesis embodying the above pieces of research.

3. Proceeded to England in 1925 with University Scholarship and joined the Chemical Engineering Department of the University College, London. After completing the course of lectures and experiments in Chemical Engineering, worked under the guidance of Prof. Gibbs on the "Heat of absorption by silica Gel" in view of the great technical and theoretical importance of the subject. Developed a special apparatus for the purpose and obtained results of considerable interest. These formed the subjects of thesis for the Doctorate of Philosophy of the University of London in 1931. While in London studied the Technology of Rubber in the Northern Polytechnic for one year. Also visited numerous factories in England and abroad with a view to study the details.

After return to India in 1932, has occupied himself with numerous industrial problems with promising results. Among these several such as the manufacture of anhydrous sodium sulphate required in the mill industries, the manufacture of ammonium chloride, magnesium sulphate, etc., have attracted the attention of the capitalists in Bombay after demonstration of the work on a semi-commercial scale and large scale plant has been erected for anhydrous sodium sulphate.

Also designed and built a semi-large scale plant for the manufacture of sulphuric acid by using vanadium catalysts in the Indian Institute of Science.

Was for some time the chief chemist and Chemical Engineer to the Karnatic Chemical Works. Was responsible for erecting plants for the manufacture of soap and for the solvent process of extraction of oil from Dhupa.

## ANNEXURE II.

COPY OF LETTER FROM THE DIRECTOR OF INDUSTRIES, BOMBAY, No. I.B.-150/8589, DATED THE 13TH OCTOBER 1934.

SUBJECT :—*Extraction of Nicotine commercially from tobacco waste.*

With reference to Government endorsement No. 614/33/11718-D., dated the 8th October 1934, forwarding copies of letter from the Secretary, Imperial Council of Agricultural Research No. F.-23-34/Agri., dated the 21st September 1934 and accommodations on the subject noted above and to state as follows :—

The Professor of Entomology, College of Agriculture, Poona, wrote in June last as the Industrial Chemist of this Department during his investigations on the control of aphids he found that Black Leaf 40—an American proprietary product—and Derrisol, a British proprietary product were efficient for the complete 'kill' of the pest. He further stated that the manufacture of Derrisol was discontinued by the British firm and the Black Leaf 40 is not always available in India. He therefore requested the Industrial Chemist whether it would be possible for him to investigate and find out whether it would be feasible to prepare the insecticide commercially in the Bombay residency.

The Industrial Chemist undertook the work and studied all the methods and attempts on the production of Nicotine as Nicotine Sulphate was found to be the active ingredient of one of the proprietary products referred to above. He has been extracting Nicotine on a laboratory scale with the help of one of the Technical Chemistry scholars of this Department. He has extracted Nicotine from tobacco grown in various parts of this Presidency and also from tobacco waste available from the cigarette factories in Bombay. It was found that a certain variety of tobacco grown in Gujerat known locally as 'kalia' actually yielded 7.9 per cent. Nicotine whereas the discarded tobacco stems from cigarette factories yielded about 2 per cent. Nicotine. At present he is trying to work out sufficient data for the extraction of Nicotine from various tobaccos which would enable him to design a pilot plant for the extraction of about 1 lb. of Nicotine of commercial quality per day.

Investigations are also being carried out to standardise the product and to prepare an insecticide more or less similar to the well known Black Leaf 40 which is a standardised form of Nicotine Sulphate with perhaps some stabilising agent in it.

Results of the experiments carried out, so far, are encouraging and it is hoped to work out the economics of process standardised by the Industrial Chemist after completion and trials of the pilot plant.

## APPENDIX XIV.

NOTE, DATED THE 28TH JANUARY 1935, BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT NO. 30 :—APPLICATION FROM THE DIRECTOR, IMPERIAL INSTITUTE OF AGRICULTURAL RESEARCH, PUSA, FOR A GRANT OF RS. 1,01,240 SPREAD OVER FIVE YEARS FOR A SCHEME FOR THE ESTABLISHMENT AT GUNTUR IN THE MADRAS PRESIDENCY OF A SUB-STATION OF THE IMPERIAL INSTITUTE OF AGRICULTURAL RESEARCH, FOR RESEARCH ON CIGARETTE TOBACCO.

At its meeting held in September 1934 the Tobacco Sub-Committee of the Advisory Board recommended that a Central Station of the Imperial Institute of Agriculture Research, Pusa, should be established at Guntur in the Madras Presidency for research work on cigarette tobacco. This recommendation was accepted by the Board, vide relevant extracts from the proceedings of the Committee and the Board, enclosed (Annexure I).

2. As recommended by the Board, the Director, Imperial Institute of Agriculture Research has now submitted a scheme for the establishment of a Sub-Station at a cost of Rs. 1,01,240 spread over five years including non-recurring expenditure of Rs. 23,000 as far as the Council is concerned, vide enclosure to the Education, Health and Land Department letter No. F-37/35-A., dated the 26th January 1935—enclosed (Annexure II).

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

## ANNEXURE I.

EXTRACTS FROM THE REPORT OF THE TOBACCO SUB-COMMITTEE HELD ON 4TH SEPTEMBER 1934.

2. The Sub-Committee discussed the questions of :—

(i) A research programme on tobacco for the Council, having due regard to the scheme already sanctioned and to the need for further work on other types of tobacco and in the provinces (Appx. II) and

(ii) the formulation of a co-ordinated programme of tobacco research in India (Appx. III). After a careful examination of the data placed before including the recommendations of the Crop planning Conference, the Sub-Committee decided that effort should be concentrated in the first place on research and experimental work on cigarette tobacco. It was decided to recommend to the Advisory Board that the sanction given to the scheme for a Cigar tobacco Expert for Madras and Bengal (to which funds have not yet been allotted) should be withdrawn and such funds as are available devoted to work on the cigarette type of tobacco, it being open to any local Government particularly interested in the cigar tobacco industry to come up with a separate scheme for research work on this type if it is so desired. In coming to this decision the Committee was influenced by the information that the urgency for an expert curer in Bengal has passed and that the scheme as sanctioned would be of little help to Burma.

3. Recent developments in the production of bright flue-cured tobacco suitable for cigarettes in India were briefly reviewed. Practical progress has been almost entirely limited to the Guntur district in the Madras Presidency where there are now over 2,000 flue-curing barns. In North Bihar, leaf of excellent colour and texture has been produced from acclimatised American seed but it has been found impossible hitherto to get rid of the strong flavour which renders Bihar tobacco unsuitable even for blending. Virginia tobacco of excellent quality has been grown in the Saharanpur District of the United Provinces, as a monsoon crop, but this proved to be un-economic owing to the 'Spot' disease. The production of cigarette tobacco as a rabi crop in the United Provinces has not been studied in detail but the long period of intense dryness at the harvest period presents difficulties. Some promising preliminary results have been obtained in the Kaira district of the Bombay Presidency.

4. It was decided that the question of flavour must be tackled first as there appears to be no difficulty in securing the necessary colour and texture. This calls for a chemical investigation of the composition of cured tobacco leaf for which it is desirable



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4. It was decided that the question of flavour must be tackled first as there appears to be no difficulty in securing the necessary colour and texture. This calls for a chemical investigation of the composition of cured tobacco leaf for which it is desirable

that two standard imported types—*Adcock* and 'Harrisons Special' should be grown under a variety of conditions. In particular the effect of soil and manure on flavour must be determined. It was agreed that a special Tobacco Sub-station of the Imperial Institute of Agricultural Research is required and that it should be established at Guntur in the Madras Presidency where tobacco of good flavour is produced commercially. At the Sub-station work could be carried out with soils brought from other parts of India and the effect of manures, etc., on quality could be fully studied. The Director, Imperial Institute of Agricultural Research undertook to prepare and submit a scheme.

EXTRACT FROM THE PROCEEDINGS OF THE MEETING OF THE ADVISORY BOARD OF THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, HELD AT SIMLA, ON THE 6TH SEPTEMBER 1934.

*3. Recommendations of the Tobacco Sub-Committee of the Advisory Board of the Imperial Council of Agricultural Research (Subject No. 34 of the Agenda).*

Mr. Burt explained in detail the various recommendations of the 'Tobacco Sub-Committee and formally moved that the portion of the Sub-Committee's Report which dealt with items 1 to 3 of the agenda of the Committee be adopted. The Chairman made it clear that members were asked to vote upon two proposals, viz. :—

(i) that the sanction to the scheme for a cigar tobacco expert for Madras and Bengal should be withdrawn, and

(ii) that a sub-station of the Pusa Research Institute should be opened at Guntur for research on cigarette tobacco. As regards (i) it was explained that the centre of gravity had shifted from cigar tobacco to cigarette tobacco and the provinces concerned did not want the cigar tobacco expert. As to (ii) Guntur was a central place in India for research work of this nature. Mr. Ritchie said that in 1916 the area under tobacco in the Central Provinces was 32,000 acres and it had fallen to about 17,000 acres in 1933. He was not aware of the reason in this fall but he felt that the acreage would recover to the original figure and possibly increase. He therefore requested the Board to include the Central Provinces and Berar in the programme of experimental work proposed by the Committee. Mr. Nizamuddin Hyder requested that Hyderabad State might also be included in the co-operative programme in view of the fact that there were 75,000 acres in the State under tobacco. Col. Noel, and Mr. Javariah put forward proposals that the N.-W. F. P. and Mysore be included in the co-operative programme of experiments. Dr. Shaw said that the question of placing experimental curing barns in the N.-W. F. P. and in Mysore should be investigated as there was a doubt as to the suitability of the climate of N.-W. F. P. for growing cigarette tobacco and of the fact that the Indian Leaf Tobacco Development Company had once made considerable purchase of leaf near Bangalore but subsequently closed their depot. Mr. Richards was doubtful whether the United Provinces Government would be able to meet the working expenses of the barns and of the staff required in that connection. He therefore requested that the matter might be left open as to whether or not Local Governments could come up to the Council for additional financial assistance in regard to the necessary staff for carrying out the proposed experiments. The Chairman explained that the Tobacco Sub-Committee's recommendation was on the distinct understanding that the recurring expenditure connected with the programme would be met by the Local Governments and if a Local Government did not accept this it would show that they were not very keen about the extension of cigarette tobacco. If any Local Government really found it difficult to meet the charge from its own budget then it could come to the Council for financial assistance and their proposals would be referred to the Tobacco Committee and the Board: this would mean a delay of a year. In answer to Dr. Burns the Chairman replied that if the research programme was approved by the Governing Body there was a likelihood of the funds being allotted in January next from the reserve which was held against the original scheme for a cigar tobacco expert. The Chairman then put the following recommendations to the vote :—

(i) That the sanction given to the scheme for a cigar tobacco expert for Madras and Bengal (to which funds had not yet been allotted) be withdrawn;

- (ii) That a Central Sub-Station of the Imperial Institute of Agricultural Research, be established at Guntur in the Madras Presidency;
- (iii) That a pair of flue-curing barns at a cost of about Rs. 2,500 be provided for the following provinces:—Punjab, Bombay, Bihar (Sabour), Burma, Bengal, United Provinces, Central Provinces, Hyderabad and one at Baroda; and
- (iv) That the question whether these experiments should be extended to the N.-W. F. P. and Mysore be investigated by Col. Noel, and Mr. Javariah, respectively in consultation with Dr. Shaw.

The recommendations were carried.

#### ANNEXURE II.

COPY OF LETTER No. F-37/35-A., DATED THE 26TH JANUARY 1935, FROM M. S. A. HYDARI, ESQ., I.C.S., DEPUTY SECRETARY TO THE GOVERNMENT OF INDIA, DEPARTMENT OF EDUCATION, HEALTH AND LANDS, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI.

SUBJECT:—*Scheme for the establishment at Guntur in the Madras Presidency of a Sub-Station of the Imperial Institute of Agricultural Research for research on cigarette tobacco.*

I am directed to forward a scheme (Enclosure II) submitted by the Director, Imperial Institute of Agricultural Research, for the establishment at Guntur in the Madras Presidency of a Sub-Station of the Imperial Institute of Agricultural Research for research on cigarette tobacco, together with a copy of his letter No. 577-D., dated the 31st December 1934 (Enclosure I). The Government of India approve the scheme which, it will be seen, involves an expenditure of Rs. 23,000 non-recurring and Rs. 78,240 recurring spread over a period of five years in the first instance. In the ordinary course the Director, Imperial Institute of Agricultural 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. It is, however, understood that the next meeting of the Advisory Board will be held in Delhi in the beginning of February next, and in order to save time, I am directed 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.

#### ENCLOSURE I.

COPY OF THE LETTER No. 577-D., DATED DELHI, THE 31ST DECEMBER, 1934, FROM DIRECTOR, IMPERIAL INSTITUTE OF AGRICULTURAL RESEARCH, REGARDING THE SCHEME FOR THE ESTABLISHMENT AT GUNTUR IN THE MADRAS PRESIDENCY OF A SUB-STATION OF THE IMPERIAL INSTITUTE OF AGRICULTURAL RESEARCH FOR RESEARCH ON CIGARETTE TOBACCO.

I have the honour to state that the Advisory Board of the Imperial Council of Agricultural Research considered at its last meeting the proposals of the Tobacco Sub-Committee for carrying out a research programme on tobacco. One of the recommendations accepted by the Board was that special tobacco sub-station of the Imperial Institute of Agricultural Research is required for work on cigarette tobacco and should be established at Guntur in the Madras Presidency where tobacco of good flavour is produced commercially.

I therefore beg to submit the enclosed scheme for the establishment of a Sub-station at Guntur to be financed by the Imperial Council of Agricultural Research and to request that, in the event of its meeting with the approval of the Government of India, it may kindly be forwarded direct to the Research Council so that it may be considered at the next meeting of the Advisory Board which will be held during the ensuing cold weather.

The scheme is proposed to be worked for a period of 5 years in the first instance and the total cost involved for the 5 years period is estimated at Rs. 23,000 non-recurring and Rs. 78,240 recurring.

## ENCLOSURE II.

## SCHEME FOR RESEARCH ON CIGARETTE TOBACCO AT A SUB-STATION OF THE IMPERIAL INSTITUTE OF AGRICULTURAL RESEARCH.

The objects of this scheme are fully set out in the report of the Tobacco Sub-Committee of the Advisory Board of the Imperial Council of Agricultural Research held in September 1934. The scheme for the establishment of a Tobacco Sub-Station at Guntur in the Madras Presidency was approved by the Advisory Board and detailed estimate are submitted below.

2. The scheme contemplates research on five distinct problems of cigarette tobacco. The work already carried out at Pusa has shown that crops of satisfactory texture, colour and yield can be raised and that what is required now is an improvement in flavour. This may be accomplished by investigation of manurial conditions combined with the testing of varieties and the breeding of new types. At the same time, a chemical enquiry into the changes which take place during and after curing may throw light on this problem. A factor of considerable importance in successful tobacco cultivation is the incidence of leaf curl disease. The cause of this disease and its control are unknown and as the Sub-Station will be in close contact with the Imperial Institute of Agricultural Research, which possesses a complete staff for the investigation of pathological problems, it would be folly not to take advantage of the opportunity to investigate the disease problem.

3. The work of the Sub-Station may, therefore, be summarised as follows :—

(1) *Manurial experiments.*—Testing the effect of different manures on the cured leaf.

(2) *Curing experiments.*—The process of curing is already an established method, thanks to the work done in the Botanical Section, Pusa. Curing experiments will consist in the curing of leaf produced under different manurial and cultural treatments and testing the value of the product.

(3) *Chemical.*—Chemical analysis of leaf at different stages of curing and aging to discover whether the problem of flavour can be correlated with any chemical difference which in its turn may, be dependent on cultural methods or dependent on some intrinsic varietal property.

(4) *Breeding new types.*—This may be taken up when some progress has been made in the above three items.

(5) *Leaf curl disease.*—This will demand the co-operation of the Botanical, Mycological and Entomological sections of the Imperial Institute of Agricultural Research working on the material provided by the Sub-Station. The four chief types of diagnostic features employed to differentiate plant viruses are : (a) symptom expression, (b) properties of the virus, (c) modes of transmission and (d) the cytological picture. (a) and (d) can be adequately done only in the Botanical Section as (a) entails a detailed botanical description based on the complete life-history of the plant. The symptoms of a particular virus in the juvenile and adult stages may vary; they may also vary from variety to variety. Large populations of *pure lines* of several varieties of tobacco (and it may be of a few other related plants) will therefore have to be grown, and this, it is obvious, can best be done in the Botanical Section. It is needless to comment that a cytological study is also best done by the Botanical Section. (b) Properties of the virus, e.g., filterability, etc.—are perhaps best done by the Mycological Section, while (c) The study of the modes of transmission and the identification of the vector or vectors will be important contribution of the Entomological Section. The Botanical Section, however, will be able to supply information as to whether "curl" is transmissible by grafting or inoculation. For the purpose of the entomological enquiry one special assistant for tobacco work will be required, the mycological and botanical sections will not require strengthening for this work.

4. The scheme which should be run for a period of 5 years in the first instance will thus consist of—

(1) Sub-station at Guntur.

(2) Work at Botanical Sub-station, Pusa.

(3) Investigations by chemical, botanical, mycological and entomological sections of the Imperial Institute of Agricultural Research.

It is estimated to cost Rs. 23,000 non-recurring and Rs. 78,240 recurring for the five year period as detailed below :—

*Non-recurring expenditure for Sub-station at Guntur,*

	Rs.
20 acres land . . . . .	10,000
2 flue curing barns . . . . .	3,000
3 pairs bullock . . . . .	1,000
Agricultural implements . . . . .	1,000
 Buildings—	
Godown . . . . .	} . . . . . 8,000
Bullock shed . . . . .	
Office . . . . .	
Total . . . . .	23,000

*Recurring Expenditure,*

	Rs.
Staff as per details given in the enclosed statement for 5 years . . . . .	27,240
Contingencies (cultivation, labour charges, etc.) @ Rs. 7,200 per year (for five years) . . . . .	36,000
Travelling allowance for officers of the Imperial Institute of Agricultural Research to visit Sub-station, and Pusa, @ Rs. 3,000 a year (for 5 years) . . . . .	15,000
Total . . . . .	78,240

5. Nothing has been put down for quarters at Guntur as staff can live in the town. At Pusa, the entomological assistant can be provided with a quarter. All material, etc., required for chemical, mycological and entomological work will be provided by the Imperial Institute of Agricultural Research but the Imperial Institute of Agricultural Research cannot find travelling allowance.

6. The establishment of flue curing barns in the provinces is also recommended by the Advisory Board and will enable the investigation on manure and the chemical changes in the leaf to be carried out on a wider basis.

F. L. SHAW,

Director of Imperial Institute of Agricultural Research.

*Statement showing details of recurring expenditure on account of staff proposed under the scheme for research on cigarette tobacco.*

	1935-36	1936-37	1937-38	1938-39	1939-40	Total.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
<i>Staff (for the sub-station)—</i>						
(a) (1) One Superintendent. (150—10—250).	1,800	1,920	2,040	2,160	2,280	
(2) Two Currers (30— 4—50) each.	720	816	912	1,008	1,104	
(3) One Mali (30—4— 50).	360	408	456	504	552	
(b) One Assistant Ento- mologist for leaf curl disease (150 —10—250).	1,800	1,920	2,040	2,160	2,280	
	4,680	5,064	5,448	5,832	6,216	27,240

## APPENDIX XV.

NOTE DATED THE 23RD JANUARY 1935, BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT No. 34 :—REPORT OF THE TRACTOR PLOUGHING WORK CARRIED OUT BY THE BURMAH-SHELL OIL STORAGE AND DISTRIBUTING COMPANY OF INDIA, LIMITED, BOMBAY, DURING THE 1933-34 SEASON.

Attention is invited to the attached Note (not printed) dated the 2nd June 1934 (and its accompaniments) on the subject mentioned above, circulated to the Advisory Board at its meeting held in September 1934. The report of the Burmah-Shell Company was considered by the Tractor Committee. As the Committee was to meet after the conclusion of the Advisory Board's session, the Board decided that its report should be circulated and considered at the next meeting of the Advisory Board.

2. Three of the shares used in these experiments *vide* report pages 11 to 13, have now been received and descriptive notes are given in Appendix 3. These will be available for inspection by members of the Board during the meeting.

3. The report of the Committee is now attached (Encl.) and is for the consideration of the Board. The suggestion contained in paragraph 2 of the report has been duly conveyed to the Burmah Shell Company with a copy of the Committee's report. Further progress in the matter will be reported to the Board in due course.

## ENCLOSURE.

Report of the Tractor Sub-Committee.

## PRESENT:

Diwan Bahadur Sir T. VIJAYABHAVACHARYA (Chairman).

Dr. W. BURNS.

Mr. B. C. BURT.

Khan Bahadur Maulvi FATEH-UD-DIN.

The Hon'ble Mr. E. MILLER.

Mr. S. V. RAMAMURTY.

Mr. P. B. RICHARDS.

Mr. C. V. SANE.

Mr. D. R. SETHI.

The sub-committee considered the report on the experimental work carried out by the Burma Shell Oil Storage and Distributing Company during the season, 1933-34. The Hon'ble Mr. E. Miller who kindly attended the committee, gave full particulars of the work done and answered a number of questions. The sub-committee desires to express its appreciation of the work carried out on this small scheme and considers that valuable results have been obtained.

2. The sub-committee was informed that the Burmah Shell Corporation is now interested in a scheme for ploughing some 4,000 acres of weed-infested land in the Bombay Presidency to a depth of 12 inches and that if the Bombay Government accept the scheme the Bombay Department of Agriculture will assist by the loan of canvassers and by the provision of a Botanical Assistant to take observations on deep-rooted grasses met with and what happens when these are ploughed out. This work is, being carried out on a commercial scale with a 30-H. P. tractor at a contract rate of Rs. 18 per acre. The sub-committee considers that it would be a very great advantage if, during the progress of this scheme, the testing of different types of plough shares on black soil could be continued to supplement the very interesting results contained in the present report. The sub-committee would also greatly appreciate a report on the above-mentioned commercial deep ploughing scheme if the Burma Shell Corporation should find itself in a position to supply one.

As regards the publication of the present report, it was unanimously decided that it should be included as an appendix in the monograph which is now going through the press.

B. C. BURT,

*Agricultural Expert.*

SIMLA;

*The 8th. September 1934.*



## APPENDIX XVI.

NOTE DATED THE 26TH JANUARY 1935, BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT NO. 35 :—APPEAL FOR AN ENDOWMENT FUND FOR A CENTRAL LIBRARY FOR ANIMAL DISEASES FROM THE ROYAL COLLEGE OF VETERINARY SURGEONS.

Attention is invited to the attached letter from the Secretary, Royal College of Veterinary Surgeons, London, No. 1533, dated the 10th May 1934 (Annexure I)—forwarding an appeal (Annexure II) for an endowment fund for a Central Library for Animal Diseases.

2. The Secretary, Executive Council of the Imperial Agricultural Bureau, has been supplied by this Department with a copy of the appeal and requested to obtain the opinion of the Executive Council of the Bureau on the appeal and to communicate it to the Council. The reply when received will be circulated to the Board. (Since circulated please see Annexure III).

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

## ANNEXURE I.

COPY OF LETTER NO. L-533, DATED THE 10TH MAY 1934, FROM THE ROYAL COLLEGE OF VETERINARY SURGEONS, 10 RED LION SQUARE, LONDON, W.C.-1, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA.

I am directed to send you a copy of the Appeal (Annexure II) which is now being issued for an Endowment Fund for the Central Library for Animal Diseases, established by this College, in the hope that the Imperial Council of Agricultural Research may consider that it is a work which deserves their support. The Library has been consulted by Indian graduates in veterinary science who have been engaged in this country on special research work, and I have recently had the pleasure of presenting, with the full sanction of the Council, a copy of Volume 1 of the Quarterly Journal of Veterinary Science in India to Mr. Frank Ware for the Library at Muktesar. This volume is extremely scarce, but as it was only right that the Library at Muktesar should contain a complete set of the volumes of this, the first, veterinary periodical to be published in India, my Council had no hesitation in presenting a duplicate copy of Volume I which we happened to possess. This is but one instance of the valuable services the Library can render. Its general claim to public support is outlined in the enclosed documents, and I sincerely hope that your Council may see their way to making a grant in aid of the Endowment Fund.

## ANNEXURE II.

ROYAL COLLEGE OF VETERINARY SURGEONS. A CENTRAL LIBRARY FOR ANIMAL DISEASES.  
APPEAL FOR AN ENDOWMENT FUND.

The Library of the Royal College of Veterinary Surgeons, at 10, Red Lion Square, London, contains a unique collection of literature upon all subjects relating to animals in health and disease. This literature has been gathered during the last 100 years and comprises books, monographs, periodicals and reports from all parts of the world. Scientific workers may borrow these for reasonable periods or may study in the Library itself. The literary resources which the Library possesses cannot be found to a like extent elsewhere because no other institution possesses so many complete sets of British and Foreign veterinary periodicals.

The Library was remodelled by the Council of the Royal College in 1927, and formally opened by Colonel L. S. Amery, Secretary of State for Dominions, in 1928. It is one of the few selected National Libraries whose resources are indexed in the 'World List of Scientific Periodicals', and is an outlier to the National Central Library. In the latter capacity its contents are available for students of all branches of science in any part of British Isles. It has not only been of immense assistance to those engaged in the study and investigation of animal diseases in this country, but scientific workers from every part of the Empire have become aware of its value and are making increasing use of its resources.

Within recent years it has become more and more evident that the growing needs which the awakening of public interest in animal diseases has created cannot be satisfied by the restricted service which, owing to lack of funds, the Library can at present render. Since the utility and efficiency of a library depends, not only upon the value of its resources in books and periodicals, but especially upon skilled library service it is obvious that the present small Library Fund—the net income from which is less than £80 per annum will have to be augmented. The Council have supplemented this income by such maintenance grants, never exceeding £100 in any one year, as they have been able to provide from their limited general funds, in addition to small sums they have received from outside sources, notably the Carnegie (U. K.).

*Trustees.*—The maintenance of an efficient library service, including the annual cost of new books and periodicals, and the salary of a qualified whole-time Librarian, requires a capital endowment estimated at £25,000.

In their desire that the Library services should be developed and extended the Council invite contributions from those interested in veterinary science, public health and agriculture, as well as from all who have the welfare of animals at heart. The wider and more efficient the Library services can be made, the greater will be the benefits conferred. The Council are convinced that the additional expenditure contemplated will be more than justified, and accordingly ask for generous contributions.

S. H. GAIGER, *President.*

J. BASIL BUXTON, }  
G. H. LOCKE, } *Vice-Presidents.*

G. H. LIVESEY,

*Chairman of Library Committee.*

P. J. SIMPSON,

*Hon. Treasurer.*

Contributions should be sent to the Secretary, Royal College of Veterinary Surgeons, 10, Red Lion Square, London, W. C. 1.

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#### ANNEXURE III.

COPY OF LETTER No. B./394, DATED THE 1ST FEBRUARY, 1935, FROM THE SECRETARY, IMPERIAL AGRICULTURAL BUREAUX, LONDON, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI.

*Endowment Fund or the Central Library for animal diseases, Royal College of Veterinary Surgeons.*

I have just received your letter No. D.-547/34/Vet. of 21st January and note that you request an answer before the third week of February. It would be difficult to arrange a full meeting of my Council in time to permit of a written answer reaching you by that date. I have, therefore, spoken to one or two members and have made some enquiries. I trust that this letter may be of assistance to you, though, of course, it should not be read as embodying an opinion of Council reached after open discussion.

2. The opinion is that this is a matter solely for your own generosity. The position of the Royal College of Veterinary Surgeons as a centre of instruction needs no commendation on my part. Many veterinary officers in India have doubtless been trained there; but it is an Institution like several others at which specialists have been professionally trained and have later found employment primarily in the United Kingdom but also in other parts of the world. I understand from several sources that a considerable improvement in the library of the Institution is very desirable. Whilst that is so, and whilst I again say that my Council has not discussed your letter and so I cannot communicate Council's opinion, I must say that had a suggestion been made to my Council by the College that Council should endorse their appeal by suggesting to all governments of the Empire that government organisations in Empire countries overseas should contribute to this fund, I should have been very surprised had my Council agreed to any such action. In fact, though I have much sympathy with the object of the appeal, I, last year, discouraged a suggestion that Council be asked to subscribe itself to this endowment fund. Such a subscription was not essential for the discharge of the duties which have been laid on Council and would, I think have been beyond the purposes for which the governments have provided Council with funds. It might also have served as a precedent for similar requests from other institutions in which improvements in their libraries were desirable.

3. There may be special reasons applicable to India justifying a grant from your resources. Of those I have no knowledge, but I know of no general reasons nor of any particular ones connected with the working of the bureaux system which would justify a recommendation by the Executive Council of the Bureaux that a grant should be made from the State funds of overseas governments to this library.

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## APPENDIX XVII.

NOTE DATED THE 5TH FEBRUARY 1935, BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT No. 36.—ENQUIRY FROM THE DIRECTOR OF ECONOMIC ENTOMOLOGY OF THE COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH, FOR THE APPOINTMENT OF AN ENTOMOLOGIST IN INDIA AT THEIR COST TO STUDY THE NATURAL CONTROL OF BLOW-FLIES AND BUFFALO-FLY.

Attention is invited to the enclosed letter (Annexure I) from the Chief of the Division of Economic Entomology, Council for Scientific and Industrial Research, Australia, enquiring as to whether an entomologist could be appointed in India at their cost to study the natural control of blowflies and buffalo-fly. The Director, Zoological Survey of India, and the Director, Imperial Institute of Veterinary Research, have been asked to supply information on the following four points:—

- (i) A brief summary of such information as may be available on the blowfly and buffalo-fly infestation in India.
- (ii) Whether an Entomologist of the requisite type would be likely to be available in India, and if so, at what rate of pay.
- (iii) Whether the proposed investigation could suitably be carried out under their control and where it is considered that the Entomologist should be located.
- (iv) The additional cost, excluding the pay of the Entomologist, that would be necessary for laboratory accommodation, apparatus, etc.

The information when received will be circulated to the Advisory Board. (The replies will be found in Annexures II and III).

2. The subject is for the consideration of the Board.

## ANNEXURE I.

COPY OF THE LETTER No. S-5/50, DATED THE 3RD AUGUST, 1934, FROM THE COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH, CANBERRA CITY, F.C.T., TO DR. S. R. CHRISTOPHERS, PASTEUR INSTITUTE OF INDIA, KASAUJI.

As you are probably aware, we are greatly concerned in this Division with the problem of finding some method of controlling sheep blowflies, and the buffalo-fly (*Lyperosia exigua*). We are endeavouring to follow up all lines of investigation which show any promise of leading to results of economic importance, and naturally we are not neglecting to look into the possibility of controlling these pests by biological means although we do not feel very hopeful about the success of this method. I had intended to send a member of the staff of this Division to India to study the natural control of blowflies and of the buffalo-fly there, but I find that the expense of such an undertaking would be very great. It has occurred to me that the investigation could be carried out efficiently and at far less expense if a trained native entomologist could be employed to carry out the work under adequate supervision. I am therefore writing to you to ask if you know of any suitable native entomologist who could be employed on the work, and whether you would be prepared to undertake the supervision of the work. Naturally, the whole expense of the investigation would be borne by this Division.

If you are prepared to assist us, I shall, of course, send you a detailed programme of the work I wish to have carried out, in the meantime I will just give you a bare outline of the kind of work I have in mind.

At present we have very little information about the buffalo-fly in India, so we would like to have as much information as possible about the distribution, abundance, and economic effects of this pest in different parts of India. We also want to know what parasites, or other natural enemies, attack the buffalo-fly, and whether competitors, such as *Scatophaga* and *Hydrotaea*, occur in India, and we also want to know whether these insects have any appreciable effect on the abundance of *L. exigua*. If we can get such information we can compare it with that already obtained from Java and North Australia, and so decide whether there is any point in introducing any natural enemies or competitors from India.

As to blowflies, our work in Europe and Australia has shown that, in these continents at least natural enemies and competitors have negligible effect on the abundance of blowflies. The total abundance is determined, by the availability of food, and the abundance of any given species is determined almost entirely by the competition of other species of blowflies. We suspect that blowflies throughout the world are controlled in this way, but there may be parts of the world in which the major control is exercised by natural enemies. It is for this reason that we wish to have the ecology of blowflies studied in India. I think a set of experiments similar to those described by Holdaway in "Nature" would give us the information we need. I am sending you a copy of this article together with a set of reprints of other papers on blowflies and on the buffalo-fly, published by members of the staff of this Division.

I shall be indeed grateful if you can see your way to assist this Division in the way I have indicated. If you can, please give me some indication of the probable cost of the investigation. I think that two years' work would probably give us the information we need.

#### ANNEXURE II.

COPY OF A LETTER No. 238, DATED THE 11TH FEBRUARY 1935, FROM THE DIRECTOR, ZOOLOGICAL SURVEY OF INDIA, CALCUTTA, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI.

In reference to your letter No. D.1308/34-Vet., dated the 23rd January 1935 (not printed). I have the honour to say that no accounts of the blowfly and buffalo-fly infestation in India have been published so far. Systematic works on these forms have been published by Brunetti, Patton, Aubertin and Senior White mainly in the *Records of the Indian Museum*, while cases of myiasis due to these flies chiefly in man and in one case in goat, have been described by Patton and Sinton in the *Indian Journal of Medical Research*. I wrote to Mr. Senior White, Malariologist of the Bengal Nagpur Railway, who is an authority on these forms, requesting for further information, and enclose herewith a copy of his letter (Enclosure) for your information. As suggested by him, it would be useful if the Civil Veterinary Departments were first approached in reference to the occurrence of the 'blowing' of sheep in any locality or localities in India.

As Mr. Senior White says, it is not possible that an Entomologist with the necessary training in the type of work would be available in India, but a fully qualified entomologist could after preliminary training carry out the proposed investigations under my control. I can provide the necessary laboratory accommodation and the ordinary apparatus, but the cost of all special apparatus and other requisites will have to be borne by the Council for Scientific and Industrial Research, Australia. As it is not possible to be definite in the first instance regarding the centres where the work has to be carried out in the field, I consider it would be best for the entomologist to make himself familiar with the necessary literature, etc., in Calcutta where alone most of the necessary literature is available. The cost, so far as I can roughly estimate, would be as follows:—

	Rs.
Pay of Entomologist, Rs. 350—Rs. 400 a month for two years	9,000
say	9,000
2 Laboratory and Field Assistants and a Chaprassi, Rs. 120 a month	2,880
Travelling allowance, Rs. 250 a month	8,000
Contingencies, etc., for two years Rs. 5,000	5,000
	22,880
	or Rs. 23,000.

#### ENCLOSURE TO ANNEXURE II.

COPY OF LETTER D. O. No. 2/7630, DATED THE 7TH FEBRUARY, 1935, FROM R. SENIOR-WHITE, ESQ., MALARIOLOGIST, B. N. RAILWAY, CALCUTTA, TO DR. BAINI PRASAD, DIRECTOR, ZOOLOGICAL SURVEY OF INDIA, CALCUTTA.

With reference to your D. O. No. 183, dated the 4th instant (not printed) covering correspondence on buffalo and blow-fly investigations.

"I have been through my m.s. catalogue, and find that beyond systematic work by Brunetti, Patton, Aubertin, and myself, and the myiasis work by Patton and Sinton published in *Ind. Jo. Med. Res.*, there is nothing on record in India. That there is no serious 'blow-fly' problem in this country is perhaps explained by the fact that *Lucilia scricata*, which the Australians now consider as the primary cause of 'strike' on sheep, is only recorded in this country from Kurram Valley, North-West Frontier Province; for *L. flavipennis* Mq. (an undoubted synonym) described from Ceylon, is probably a case of wrong labelling as no further specimens have turned up from the Island. None of Patton's myiasis records refer to sheep, and only one to a goat.

"I think even less work has been put in on *Lyperosia*. As regards competitors for larval food against the latter, *Scatophaga* in India is, as far as I know, only represented by the European *Stercovaria* in the Himalaya, whilst of the four sp. of *Hydrotaea* in Wulp, Stein has put two in other genera. But I am very ignorant on 'Anthomyids' myself. On the other hand, there is in India enormous food competition in cow-dung, nearly all the numerous *Muscas* being involved.

"The whole proposed investigation is fascinating, and I envy the man who gets it. Undoubtedly the best man for the job in this country is Swaminath, if he can be got hold of. I think he is working with Shortt in Madras under the Research Fund, which might, in its present financial state, be glad to loan him for two years, if Shortt will part with him. S. K. Sen, of Muktesar, is in Europe, at Cambridge I believe, and in any case he is not as good a field entomologist as Swaminath. Failing this, it will be necessary to take any entomologist and train him *de novo*, and who is to do the training? I certainly can't, in Calcutta. In any case, I don't suppose Australia would pay for a man who would have to learn his work first.

"As regards a locality for the investigation, I think it would be best to ask the Civil Veterinary Departments if there is anywhere 'blowing' of sheep commonly occurs in India, and start there. For *Lyperosia* work almost any place is suitable but it would be well to locate work in an area with a short winter, or none at all, to save time.

I do not think question (iv) can be answered until the programme for work is received from Australia."

### ANNEXURE III.

"COPY OF THE LETTER No. C./80, DATED THE 15TH FEBRUARY, 1935, FROM THE DIRECTOR, IMPERIAL INSTITUTE OF VETERINARY RESEARCH, MUKTESAR, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI.

SUBJECT: *Blow fly and buffalo fly infestation in India.*

Reference.—Your letter No. D.-1308/34-Vet., dated the 23rd January, 1935.

In reply to your letter quoted above, I have the honour to enclose herein two copies of a note by Mr. S. K. Sen, Entomologist at this Institute, incorporating such information as is available on blow-fly and buffalo fly infestation in India, and I suggest that one copy of this be sent to the Chief of the Division of Economic Entomology, Council for Scientific and Industrial Research, Australia, for his information.

It may also be stated that we consider that an Entomologist of the type required could be obtained in this country on about Rs. 300 per mensem. He should be classed as a gazetted officer and entitled to Class II rates of travelling allowance. If a Government servant, pensionary contribution would also have to be paid by the Australian Government.

Until more details of the work required to be done are supplied by the Chief of the Division of Economic Entomology, it is not possible to say how much of it could be carried out at Muktesar, but in any case the officer appointed could be attached to the Entomological Branch of this Institute, and work under Mr. Sen's supervision and under the administrative control of the Director of the Institute.

The officer appointed will certainly be required to tour, probably a good deal, and I suggest that a sum of Rs. 2,000 per annum should be allowed for the travelling allowance of himself and his staff. He will require a trained Laboratory Assistant and a peon, and I suggest a pay of Rs. 75 and Rs. 14 per mensem for these respectively.

The sanction of the Government of India will have to be obtained for the accommodation of this officer in one of the laboratories of the Institute, but I do not anticipate any difficulty in obtaining this. The amount of equipment which he will

require will be small and I consider a sum of Rs. 25 per mensem will be sufficient to cover the cost of this.

There is also the question of his housing accommodation, which is more difficult, for we are very short of Class II officers' bungalows at Muktesar. If a Government building is not available then attempts will have to be made to find private quarters for him. In either case it may be estimated that a sum of about Rs. 40 per mensem will be required for house rent.

A NOTE ON BLOW-FLY AND BUFFALO-FLY INFESTATION IN INDIA, BY S. K. SEN, M.Sc., F.R.E.S., IMPERIAL INSTITUTE OF VETERINARY RESEARCH, MUKTESAR.

A.—*Blow-flies in India.*

Although blow-flies are not known to be important pests of sheep in India, some of them have been recorded as causing extensive myiasis in both man and animals in this country. Of these, mention may be made of:—

(1) *Chrysomyia bezziana*.—This species is of widespread occurrence in India. Patton (1920) has recorded numerous cases of both human and animal myiasis caused by this fly, from practically all parts of India, and since the publication of his observations, a number of additional cases have been recorded by different workers from time to time, so that *C. bezziana* would appear to be by far the most important myiasis-producing fly in this country. It is noteworthy that the larvae of this species do not as a rule, thrive on dead meat but on living tissues.

(2) *Lucilia argyricephalo*.—Recorded from Bombay, as causing occasional myiasis. This is a common bazaar meat and sweet-meat fly and is widely distributed in India up to an altitude of 6,000 ft. (Patton, 1921).

(3) *Lucilia sericata*.—Recorded by Sinton, 1921, from Parachinar, North-West Frontier Province, India, as causing myiasis in man, but Patton (1922) states that he has not seen specimens of this fly from India.

(4) *Chrysomyia megucephala*.—Recorded as causing myiasis in animals at Bannu and Bombay. It is known to suck juice exuding from the palm spathe (Fletcher, 1914). It is the common bazaar blue bottle in India.

A number of other species of blow-flies are known to occur in India although (so far as it can be gathered from the available literature on the subject) none of them has as yet been found to cause myiasis in man or animals. Of these, the following species may be mentioned:—

(5) *Calliphora erythrocephala*.—A common blow-fly at Muktesar, several broods of this species having been reared at the Entomological Laboratory of the Institute.

(6) *Chrysomyia albiceps* (= *C. rufifacies*), the well-known sheep-maggot pest of Australia. It is widely distributed in India, but has not, as yet, been noted as causing myiasis. It is of interest that, according to Paxton, its second and third-stage larva (particularly the latter) are predaceous, feeding on the larvae of other species that may be present.

(7) *Sarcophaga ruficornis*.—Believed to be a common myiasis-producing fly in India. Recorded by Sinton (1922) as causing myiasis in a dog at Bannu.

To the foregoing list may be added:

(8) *Lucilia craggi* and (9) *Chrysomyia nigriceps*, the former having been recorded from South India Hill stations and the latter from Coonoor Ghat and Shillong. Both these species are mentioned by Patton as being "very efficient scavengers" and may therefore prove to be successful competitors against other species of blow-flies.

In relation to the question of the ecology of blow-flies, it is of interest that Howlett and Patel, at Pusa, carried out a series of observations. "On the attraction exercised on flesh flies and other insects by dead animal matter in different stages of putrefaction", a summary of these observations having been embodied in the Report of the Pusa Institute for 1916-17 (pp. 91-96). It was found by these workers that *Phycosoma flaviceps* (presumably *Chrysomyia megacephala*) was attracted to over-ripe cut mango fruit and also to a plant, (probably *Justicia*), when in flower, in large numbers. They also mention a "Calliphorid fly" probably a species of *Chrysomyia* as being predaceous, in its larval stage, on *Sarcophaga* and *Phycosoma* and also on certain species of Phorid larvae. At times of scarcity of food, the larvae of this species were even observed to develop cannibalistic habits. They also mention *Necrobia rufipes* (Cleridae) as eating dead maggots and dead or damaged fly pupae,

whilst four species of Histeridae were observed by them as preying upon "flesh fly maggots of any species but preferably of big species." It was further noticed by them that species of Calliphorids and *Sarcophaga* breeding in flesh were subject to the attack of three species of parasites two of which belonged to the family Chalcidae. Two out of these three species of parasites attacked flesh fly maggots in their larval stage, one hibernating in the larval state inside the flesh fly pupae. The third species of parasite was "very minute" and attacked chiefly maggots of small species (e.g., those of Phorids) but was also bred from pupae of *Sacrophaga* and *Phenosoma*.

#### B.—The Buffalo-fly in India.

There is very little information on record concerning the extent of infestation caused by the buffalo-fly in India. In 1907, Lefroy published an account of the life-history and habits of this fly (Pusa Bulletin No. 7). According to this account, *L. exigua* attacks horses, cattle, buffaloes, goats and occasionally guinea pigs and also human beings. He further noted that the flies appeared in great numbers after rain and fed on cattle up to 10 P.M. Lefroy gives the following list of localities from which specimens of this species were collected by him: Thana (Bombay), Rungpur, Belgachia (Calcutta), Umling and Nongpoh (Assam), and Baroma (Kamrup).

In 1910, Brunetti (*Records of the Indian Museum, IV*, p. 88), redescribed the species and recorded its occurrence in (1) various localities in Travancore (nearly all taken during November, off cattle and buffaloes); (2) Chittagong, East Bengal (collected during August-September, but host not stated); (3) Bombay (two specimens only taken off cattle, during May and October); (4) Sukna (collected during August but host not stated); and (5) Calcutta (numerous specimens collected during August in the slaughter-house).

It is of interest that according to Cross (1922), "Lyperosia are very widely distributed, especially in areas (e.g., Deg. Nala area) where Surra is known to be very prevalent" (*Preliminary Report of the Fly Survey of the Punjab*, p. 7).

Before concluding this section, a reference may be made to what information is available concerning the known or suspected enemies of *L. exigua* in India. In this connection, one naturally regards with some suspicion the fossorial wasp, *Oxbelus squamosus*, sm., which is known to stalk and seize *Philaematomyia insignis* (= *Musca crassirostris*) in this country, and according to Lefroy (l.c.) the wasp also attacks *Stomoxys calcitrans*, although this has been disputed by Fletcher (Some South Indian Insects, p. 280; 1914). *O. Squamosus*, however, is not as yet known to include *L. exigua* amongst its preys. Lefroy mentions spiders and lizards as the "known enemies" of the buffalo-fly in India. (l.c., p. 36).

It would appear from the copy of letter No. S-5/50, dated 3rd August, 1934, from the Chief of the Division of Economic Entomology, Australia addressed to Sir S. R. Christophers, that the Division are interested in the question of the occurrence or otherwise of *Scatophaga* and *Hydrotaea* in India. One member at least of the genus *Scatophaga* (*S. stercoraria*) is definitely known to occur in this country.

In regard to this species, Howlett (1909), observes. "In the Hills at Mussoorie I have found *Scatophaga* very common, especially about excrement, and the common species (*Stercoraria*, which occurs also in Europe) is very conspicuous from the yellow woolly hairs with which the male is covered (*Indian Insect Life*, p. 630, the species is also figured in Plate LXVII of this book).

A passing mention may perhaps be made of the possible value of birds as a check upon the spread of *L. exigua* in this country. Mason at Pusa, studied the records numerous eggs of *Stomoxys calcitrans* of birds occurring in the plains of India with a view to obtaining an indication of their usual food. Although he does not specifically mention *L. exigua* as having been recovered from any of the species of birds studied by him, he refers to the following classes of birds as including flies in their diet:—Swallows, Martins, and Swifts, the Wagtails, Fly-catchers, Bee-eaters and Sun-birds (Nectarinidae), (*Memor. Dept. Agri. India, Entom. Ser.*, III, p. 342; 1912). Similar observations were also carried out, in the Central Provinces by D'Abreu (1919), according to whom "Muscs were found in most of the Flycatchers" (*Proc. Third Entom. Meeting, Pusa, III*, p. 866).

The question of the possible value of the cattle egret as a means of controlling the buffalo-fly pest (as also blowflies) appears to have been already gone into by the Australian authorities, in consultation with the Imperial Council of Agricultural Research in India (*vide J. Sci and Indust. Res. Australia*, VI, p. 213 1933. Abstr. in *Vet. Bull.* IV, p. 522. August 1934).

## APPENDIX XVIII.

NOTE DATED THE 26TH JANUARY, 1935, BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT NO 37 :—APPLICATION BY THE UNIVERSITY OF EDINBURGH, FOR A GRANT TOWARDS THE COST OF COURSES OF INSTRUCTIONS FOR THE DIPLOMA IN TROPICAL VETERINARY MEDICINE

Attention is invited to the attached letter from the High Commissioner for India, London, No. G-68537, dated the 15th November 1934 and its enclosures (Annexure) on the subject mentioned above. For the reasons stated in paragraph 3 of his letter the High Commissioner recommends a grant of £100 for the academic year 1935-36 to the University of Edinburgh and suggests that the position should be reviewed thereafter in the light of what may in the meantime have done by other bodies to institute similar courses.

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

## ANNEXURE.

COPY OF LETTER NO. G-68537, DATED THE 15TH NOVEMBER 1934, FROM THE HIGH COMMISSIONER FOR INDIA, GENERAL DEPARTMENT, ALDWYCH, LONDON, W. C. 2, TO THE SECRETARY TO THE GOVERNMENT OF INDIA, DEPARTMENT OF EDUCATION, HEALTH AND LANDS, NEW DELHI.

I am directed by the High Commissioner to forward, herewith, for the information and consideration of the Government of India, copy of the correspondence noted at foot\* regarding an application by the University of Edinburgh for a grant towards the cost of courses of instruction for the Diploma in Tropical Veterinary Medicine.

2. It will be seen that the Diploma was instituted in 1930, and that, as it was anticipated that the courses would be attended almost entirely by officers of the Colonial Veterinary Services, a grant of £1,000 per annum for three years was made in 1931 from the Colonial Development Fund towards the cost. The actual attendances of students during the four years 1930-31 to 1933-34 has been as follows :—

Year.	Students from Colonial Departments.	Indians.	Others.	Total.
1930-31 . . . . .	6	..	..	6
1931-32 . . . . .	7	2	1 (R.A.V.C.).	10
1932-33 . . . . .	1	2	..	3
1933-34 . . . . .	4	3	1 (R.A.V.C.).	8
Total . . . . .	18	7	2	27

For the year 1934-35 the Colonial Development Advisory Committee and the Treasury have agreed to allow the unexpended balance of the grants to be utilised, and the Colonial Office propose to approach them for a further period of four years after 1934-35. The Colonial Office do not feel, however, that, in view of the fact that in the first four years of the courses students from Colonial Departments have numbered no more than two-thirds of the total, they would be justified in recommending assistance on so large a scale as hitherto, and have suggested that the Government of India might be prepared to make a grant towards the cost.

- \*1. From the University of Edinburgh, dated 26th June (Enclosure I).
2. To the Colonial Office, dated 25th July 1934 (Enclosure II).
3. From the Colonial Office, dated 20th July 1934 (Enclosure III).
4. To the Colonial Office, dated 11th August 1934 (Enclosure IV).
5. From the Colonial Office, dated 17th August 1934 (Enclosure V).



3. The estimated minimum annual income required is £785, and if the expectation of students can be taken as 6 per session the net annual grant required will be approximately £600. During the first four years taken together Indian students have been rather more than 25 per cent. of the total, as the course in question is an excellent one, there is, *prima facie*, ground for a grant up to £150 per annum. But the increasing importance and recognition of this special branch of veterinary medicine will probably lead to the establishment of similar courses at the other Veterinary Colleges and Schools throughout the country, from whom similar applications for financial assistance may be forthcoming. The High Commissioner feels therefore that this position should be closely watched, and he would accordingly recommend that a grant of £100 should in the first place be made to the University of Edinburgh for one year only, *i.e.*, for the academic year 1935-36, the position to be reviewed thereafter in the light of what may in the meantime have been done by other bodies to institute similar courses.

ENCLOSURE I.

COPY OF LETTER No. G-122-10-32, E. & O-4193, DATED THE 26TH JUNE 1934, FROM THE SECRETARY TO THE UNIVERSITY OF EDINBURGH, TO THE UNDER SECRETARY OF STATE FOR INDIA, INDIA OFFICE, WHITEHALL, LONDON, S. W. I.

*Diploma in Tropical Veterinary Medicine.*

In 1930 the University of Edinburgh instituted a Diploma in Tropical Veterinary Medicine the courses for which are open to those holding a veterinary qualification examinations to those who possess a veterinary qualification registrable by the Royal College of Veterinary Surgeons.

The Diploma is extremely valuable to those whose work lies in the Tropics and consequently it is most desirable that it should be continued.

The expense of the courses of instruction has been, and is still likely to be, very much higher than the income derived from fees, and they must necessarily, therefore, be given at a financial loss. In view of the fact that it was anticipated that the courses would be attended almost entirely by Officers of the Colonial Veterinary Services, and that the University did not find it possible to bear the whole of the expense involved, a grant of £1,000 *per annum* for three years was made in 1931 from the Colonial Development Fund towards the cost.

In addition to Officers of the Colonial Services, however, a number of Indian veterinary graduates (25 per cent. of the total in attendance) have already taken the courses of instruction for the Diploma, and have returned to India presumably better equipped for the performance of their professional duties; and it appears certain that in future Indian graduates will continue to avail themselves of the opportunities afforded by the institution of the Diploma, if it is found financially possible to continue the course.

The burden of maintaining satisfactory courses of instruction is a heavy one, and the Colonial Office has suggested that the University should explore the possibility of obtaining a part of the amount required from sources other than the Colonial Development Fund.

Accordingly, and in view of the participation of Indian graduates, I have been directed to communicate with you in order to ascertain if the Government of India would be prepared to give sympathetic consideration to an application by the University for financial assistance.

I enclose herewith a copy of the Regulations for the Diploma, and shall be glad to provide any further information desired.

ENCLOSURE II.

COPY OF LETTER No. G-122-10-32, DATED THE 25TH JULY 1934, FROM THE HIGH COMMISSIONER FOR INDIA, GENERAL DEPARTMENT, INDIA HOUSE, ALDWYCH, LONDON, W. C. 2, TO THE UNDER SECRETARY OF STATE, COLONIAL OFFICE, S. W. I.

I am directed to state that an enquiry has been received from the University of Edinburgh as to whether the Government of India would be prepared to give sympa-

thetic consideration to an application by the University for financial assistance towards the maintenance of the courses for the Diploma in Tropical Veterinary Medicine instituted there in 1930.

2. It is stated by the Secretary to the University in the course of his letter that in view of the fact that it was anticipated that the courses would be attended almost entirely by Officers of the Colonial Veterinary Services a grant of £1,000 per annum for three years was made in 1931 from the Colonial Development Fund towards their cost, and that the Colonial Office has now suggested that the University should explore the possibility of obtaining a part of the amount required to maintain the courses from sources other than the Colonial Development Fund. A certain proportion of the veterinary graduates attending the courses has come from India, and it is in consequence of this that the University has acted on the suggestion of the Colonial Office by addressing this Office on the subject.

3. The question of financial assistance from Indian revenues is one on which the High Commissioner must seek the orders of the Government of India, but before taking any further steps he would like to have knowledge of the attitude of the Colonial Office towards continuance of a grant for these courses, and if favourable, to what extent that Department proposes to finance them. He would therefore greatly appreciate any observations on this aspect which the Secretary of State for the Colonies feels himself able to furnish.

ENCLOSURE III.

Copy.

E. & O.-4790.  
1934.

THE UNDER SECRETARY OF STATE,  
COLONIAL OFFICE,  
DOWNING STREET,  
LONDON, S. W. I.

REF 32154/34.

20TH JULY 1934.

Sir,

I am directed by Secretary Sir Philip Cunliffe-Lister to state that he has received from the Secretary to the University of Edinburgh a copy of a letter addressed to you on the 26th June (Enclosure I) in which the request is made that the Government of India may be asked to consider the granting of financial assistance towards the maintenance of the Courses for the Diploma in Tropical Veterinary Medicine at the University, which have been attended during the past few years by a number of veterinary graduates from India.

2. The bulk of the additional expenditure entailed by courses has been met during the past two and a half years by means of grants made from the Colonial Development Fund. These grants were applied for because the Courses were primarily intended to serve as refresher courses for officers of the Colonial Veterinary Services.

3. As indicated by the Secretary to the University authorities, the present grants expire this year. The University authorities have approached the Secretary of State with a view to the renewal of the grants for a further period of four years, but Sir Philip Cunliffe-Lister is of the opinion that he would not be justified in approaching the Colonial Development Advisory Committee for grants on such a large scale, especially in view of the fact that the Courses have not been attended by officers in the Colonial Veterinary Service only, but by other students. It will be observed that the Secretary to the University states that no less than one quarter of the students attending the Courses have come from India, and in these circumstances, the Secretary of State sincerely trusts that the Government of India will be prepared to give sympathetic consideration to the application.

I am, Sir,

Your most obedient servant,  
(Sd.) K. V. VERNON.

## ENCLOSURE IV.

COPY OF LETTER No. G. 64332-122-10-32, DATED THE 11TH AUGUST 1934, FROM THE HIGH COMMISSIONER FOR INDIA, GENERAL DEPARTMENT, INDIA HOUSE, ALDWYCH, W. C. 2, TO THE UNDER SECRETARY OF STATE, COLONIAL OFFICE, S. W. I.

I am directed by the High Commissioner to refer to your letter No. 32154/34 of the 31st July, on the subject of application by the University of Edinburgh for financial assistance towards the maintenance of the Course for the Diploma in Tropical Veterinary Medicine, and to say that, if the matter is to be submitted to the Government of India, it will be necessary to inform them of the total amount of assistance required to enable the University authorities to continue the Course (presumably at present £1,000 a year for at least three years), and what amount is expected to be contributed from other sources.

2. The High Commissioner would, therefore, much appreciate any information on these points that the Secretary of State may be able to furnish.

## ENCLOSURE V.

COPY.

G.-65118,  
122-10-32.THE UNDER SECRETARY OF STATE,  
COLONIAL OFFICE,

LONDON, S. W. 1.

DOWNING STREET,

17TH AUGUST, 1934.

32154/34.

SIR,

I am directed by the Secretary Sir Philip Cunliffe-Lister to acknowledge the receipt of your letter No. G. 64332-122-10-32 of the 11th August (Enclosure IV), in connection with the application by the University of Edinburgh for financial assistance towards the maintenance of the courses for the Diploma in Tropical Veterinary Medicine, and to furnish the following information.

2. The extra expenditure incurred by the University in providing these courses during the period 1st January 1932 to 31st July 1933 was £1,295-14-4, and the expenditure for the academic year ended 31st July 1934 was estimated at £747-12-8. This expenditure has been defrayed by means of the grants which were sanctioned from the Colonial Development Fund in November, 1931, and the fees which have been received from students attending the courses. The grants authorised from the Fund were at the rate of £1,000 per annum for three years, and the Colonial Development Advisory Committee and the Treasury have recently agreed to allow the unexpended balance of the grants to be utilized to enable the courses to be continued during the academic year ending 31st July, 1935.

3. The University authorities last year approached the Secretary of State with a view to securing his support to an application for further grants from the Colonial Development Fund to enable the courses to be continued for a further period on the expiry of the existing grants.

Sir Philip Cunliffe-Lister, however, decided first to obtain the opinions of the Colonial Governments particularly concerned as to the measure of benefit which had been derived by the officers belonging to their Veterinary Departments who had taken the courses. The replies received showed that the general opinion was that the officers in question had derived much benefit from the courses, and that their continuance was strongly advocated. The proposals of the University were then laid before the Colonial Advisory Council of Agriculture and Animal Health, which also recommended the continuance of the courses, provided that an epizootologist, possessing knowledge of, and practical experience in, animal disease control in the tropical Colonies, and of the daily duties which Colonial Veterinary Officers, were called upon to perform, was added to the staff of the Royal (Dick) Veterinary College, or of the University, which are jointly responsible for providing the lectures for the courses.

4. The Royal (Dick) Veterinary College recently submitted an application to the Department of Agriculture for Scotland for permission to add an epizootologist to their staff, and it is understood that this application has been supported by the Department and is at the present time under consideration by the Agricultural Research Council. If the proposed application is sanctioned, and it is agreed that the officer to be selected shall possess the qualifications recommended by the Colonial Advisory Council, the Secretary of State proposes to approach the Colonial Development Advisory Committee and the Treasury for grants to provide the balance of the funds required to enable the courses to be continued for a further period of four years.

5. The University authorities estimate that the minimum annual sum required to enable them to carry on as at present arranged is £785.

6. As indicated in the enclosure to the letter from this office of the 31st July, Sir Philip Cunliffe-Lister is of opinion that he would not be justified in asking the Colonial Development Advisory Committee to recommend assistance on so large a scale as that hitherto provided, and he therefore sincerely trusts that, if the courses are continued during the four academic years commencing 1st August, 1935, the Government of India will be moved to make an annual contribution.

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## APPENDIX XIX.

NOTE DATED THE 31ST JANUARY 1935, BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT NO. 42.—PROPOSAL FOR THE CONTINUANCE OF STATISTICAL SECTION FOR FIVE YEARS FROM THE 1ST DECEMBER 1935 (WITH SPECIAL REFERENCE TO THE ADVISORY BOARD'S PREVIOUS RECOMMENDATIONS REGARDING THE PLANNING AND INTERPRETATION OF FIELD EXPERIMENTS).

Attention is invited to the attached memorandum dated the 16th September 1932 (Annexure I) circulated to the Governing Body at its meeting held in October 1932, in response to which the Governing Body sanctioned a scheme involving a grant of Rs. 35,000 for three years for the constitution of a Statistical Section at the headquarters of the Council. The Section has started on 1st December 1932 and its sanction is due to expire on the 30th November 1935.

2. The work of the Statistician, who is in charge of the Section, has come to the notice of the Advisory Board from time to time, and a statement is enclosed showing the work done by the Section since it was started (Annexure II). It may be explained that the services of the Statistician are requisitioned constantly by the Agricultural Departments of Provinces and constituent Indian States for statistical help in connection with the lay-out of field experiments, and his work during the past two years has been commended by the Fertilisers' Committee of the Council, the Crop Planning Conference convened by the Government of India, Directors of Agriculture of Provinces and constituent States, etc. It may also be mentioned in this connection that the Advisory Board, at their meeting held in August, 1933, in discussing Prof. P. C. Mahalanobis' scheme for statistical studies, emphasised that the Council's Statistical Section should specialise on field experiments. The Advisory Board have also insisted that the field lay-out and final statistical results of the agricultural schemes financed by the Council should be examined in every case by the Statistician, which is being done. In view of all this, the work of the Section has considerably expanded since it was started, and consequently the Vice-Chairman of the Council has recently had to recruit for this Section an extra assistant (an agricultural graduate with statistical qualifications) on a pay of Rs. 100 in the grade of Rs. 100—10—150 through the Public Service Commission. The Vice-Chairman considers it necessary to retain the Statistical Section more or less on a continuous basis and suggests that for the present this Section should be continued for a further period of five years with effect from the 1st December 1935.

3. Annexure III shows the staff proposed for the Section, which is the same as in the present scheme with the addition of one Agricultural Assistant recently recruited and one Duftari. The following scales of pay are proposed for the various members of the Section :—

*Statistician*.—His present pay is Rs. 600 in the scale of Rs. 550—50—600. Mr. Vaidyanathan, the present Statistician, reached the maximum of the scale in July 1933 and has had no increment since then. In view of the fact that the Statistician's services are likely to be required more or less continuously, the Vice-Chairman thinks that a long term scale of pay is required in this case and suggests that he may be brought on to the revised Pusa Scale for Class I Officers, viz., Rs. 325—25—600—E. B.—25—650—35—1,000 with an appropriate initial salary of, say, Rs. 650 p. m.

*Statistical Assistant*.—He is at present in receipt of Rs. 190 in the scale of Rs. 100—10—200, and it is proposed to increase his scale to the revised grade of the Secretariat First Division Assistants with an initial salary of Rs. 200.

*Agricultural Assistant*.—He has just been recruited in the scale of Rs. 100—10—150. This scale may be continued in his case.

*Clerk*.—He is at present in receipt of a fixed pay of Rs. 75 p. m. and it is proposed that he may be put in the revised scale for third division clerks of the Government of India, viz., Rs. 60—2—80—3—125 with an initial pay of Rs. 80.

1 Duftari on Rs. 15— $\frac{1}{2}$ —20—1—30.

1 Peon on Rs. 15 p. m.

*Travelling allowance*.—Provision for travelling allowance in the present scheme was made at the rate of Rs. 1,000 per year, but this amount has proved quite inadequate on account of frequent calls on the Statistician for visits to various provinces, etc., to advise them in the lay-out of field experiments. Actual expenditure under this head during the last three years has been—

1932-33—4 months—Rs. 358.

1933-34—Full year—Rs. 1,270-5-0.

1934-35—8 months—Rs. 1,779-11-0.

It is considered that an average of Rs. 2,000 per annum will be sufficient.

*Contingencies.*—One typewriter Rs. 500—non-recurring. Hitherto the Statistical Section has been using a type machine from the Council's main office. But owing to the expansion of the Council's work this arrangement is no longer feasible and a separate machine for the Statistical Section has become necessary.

Telephones for the Statistician both in the office and his residence and other contingencies cost Rs. 500 per annum.

*Contributory Provident Fund.*—In view of the fact that the staff to be employed in the Section will be of quasi-permanent nature, the Vice-Chairman considers that the benefits of the Contributory Provident Fund should be allowed.

On the basis of the above, the scheme is estimated to cost Rs. 90,125 spread over a period of five years, *vide* Appendix III.

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

#### ANNEXURE I.

### IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, GOVERNING BODY MEETING, OCTOBER 1932.

#### SCHEME FOR THE CONSTITUTION OF A STATISTICAL SECTION UNDER THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH AS A NUCLEUS OF THE PROPOSED BUREAU OF AGRICULTURAL INTELLIGENCE.

Attention is invited to the attached memorandum (not printed), No. 1628-Agri., dated the 15th July 1931 in which sanction of the Governing Body was requested by circulation to the establishment of a small statistical section under the Imperial Council of Agricultural Research, as a part of the proposed Bureau of Agricultural Intelligence. Of the fourteen members from whom replies were received, ten were in favour of the scheme and four were against it. Although the majority of the members agreed to the proposals, in the circumstances it was decided that the subject should be discussed at a meeting of the Governing Body.

2. The staff proposed in the memorandum of 15th July 1931 for the statistical section consisted of (a) a Statistician on a pay of Rs. 500 per mensem and (b) a Statistical Assistant on a pay of Rs. 100—10—200 with starting salary according to qualifications. On further examination, it is considered that the nature and volume of the work that will be done in the proposed section will be such that it will require, in addition to the above, at least (iii) a separate routine clerk and typist on a consolidated pay of Rs. 75 per mensem to do all the typing and other routine work of the Section and be in charge of the sectional library and (iv) a peon on Rs. 15 per mensem. No provision for these was included in the original proposals as at that time additional office staff consisting of 1 First Division Assistant, 2 II Division clerks, 1 typist, 1 daftri, and 1 peon had been sanctioned for the Council's Secretariat on the administration side and it was thought that the necessary clerical and inferior assistance could be given to the section from this staff; owing however to financial stringency the extra staff was surrendered with effect from the 1st March 1932 and consequently it is necessary to provide a routine clerk and a peon for the proposed section. Further proposals are being submitted separately to the Governing Body for increasing the pay of the Statistician and the staff of the Central Locust Bureau of the Council from Rs. 500 to Rs. 550—600. As the intention is to transfer this statistician to the post of statistician in the proposed statistical section he will have to be paid at the increased rate mentioned above instead of Rs. 500 as stated in the memorandum of 15th July 1931. Some expenditure will also be necessary on account of travelling allowance and contingencies. On the basis of the above the scheme for the establishment of a statistical section is estimated to cost Rs. 35,000 spread over a period of three years *minus* 10 per cent. deductions on account of cut on the pay of the staff except the peon as long as the cut lasts.

3. The subject is now for the consideration of the Governing Body.

CHARAN DAS,

Secretary.

The 16th September 1932.

*Budget expenditure for the proposed statistical section of the Bureau of Agricultural Intelligence (3 years).*

Item.	Salary per mensem.	Expenditure for 1 year.	Expenditure for 3 years.
	Rs.	Rs.	Rs.
1. Salary of Statistician . . . . .	1st year— (9 months)—550 } (3 months)—600 }	6,750	} 21,150
	2nd year—600	7,200	
	3rd year—600	7,200	
2. Salary of Statistical Assistant	Rs. 100—10—200— (average Rs. 150).	1,800	5,400
3. Salary of Typist and Routine Clerk . . . . .	75	900	2,700
4. Salary of Peon . . . . .	15	180	540
5. Travelling Allowance to the Statistician and his staff (including moving allowance to and from Delhi) . . . . .	....	1,000	3,000
6. Contingencies—			
(a) Typewriter and computing machine (non-recurring) . . . . .	....	700	700
(b) Other contingencies, stationery, livery to the peon, etc. . . . .	....	500	1,500
Total for 3 years . . . . .	....	..	34,990
		or say .	35,000

This will be subject to 10 per cent. cut so long as the present cut continues.

ANNEXURE II.

*Work done by Statistician, Imperial Council of Agricultural Research, after the starting of Statistical Section (i.e., since 1st December, 1932).*

(a) AGRICULTURE.

*Advising Provincial Agricultural Officers regarding lay-out of experiments and methods of statistical analyses.*

Number of references received :—

During December 1932 . . . . .	5
During year 1932 . . . . .	74
1st January 1934 to end of December 1934 . . . . .	95

174

2. \*Preparation of 3 Volumes of 'Analyses of Manurial Experiments in India', (Vol. I, pages 121, Vol. II, pp. 662 and Vol. III, pp. 101). (Fertilisers' Committee work.)

3. *Publication of Statistical Notes for the benefit of Agricultural Officers.*—The Advisory Board has asked the Statistician to publish 20 statistical notes on which one has been published, and two are in the course of publication. The published article has been well received both in India and in England. The other notes are being prepared.

\* Will be published shortly.

4. Publication of statistical tables for the benefit of agricultural experimenters (in progress).
5. Advising on 'the lay-out' of experiments in schemes financed by the Imperial Council of Agricultural Research, and examination of progress reports of schemes financed by the Imperial Council of Agricultural Research. (Recently the Statistician prepared a standard form for the presentation of experimental results which has been accepted by most of the Provinces.)
5. 'A few fundamental statistical ideas and their applications to field experiments in agriculture' is in the course of publication (lectures delivered at Padegaou, Bombay Presidency).
7. One of the Assistants under the Sugar Technologist was deputed for training on statistical methods under the Statistician.

#### (b) REVIEWING PAPERS FOR PUBLICATION.

References to the Statistician from Editorial Committee of the Council's Journal for commenting on articles received for publication have numbered 65 since the formation of Statistical Section. The advice of the Statistician had been accepted by the authors in most cases.

#### (c) ECONOMIC.

1. References to the Statistician from other Departments of Government of India on matters concerning agricultural statistics have numbered 65 (from 1st December 1932 till 31st December 1934).
2. Statistics and Graphs for Wheat Conference, and Crop-Planning Conference convened by the Government of India in 1934, were prepared by the Statistician.
3. The Statistician was asked to conduct an enquiry on rice prices in Madras, and he has submitted a report.

#### (d) MISCELLANEOUS.

Statistics on crop conditions in India and in foreign countries received by this Department are dealt with in Statistical Section.



**ANNEXURE III.**

Proposed budget expenditure for the scheme for continuance of the Statistical Section under the Imperial Council of Agricultural Research at the Headquarters (5 years from 1st December, 1935).

	Proposed grade.	Average monthly salary (on 5 years' basis).	Expenditure for 1 year.	Expenditure for 5 years.	Remarks.
1. Salary of Statistician . . . . .	650—35—1,000 (Revised Pusa Scale, Class I, 350—25—650—35—1,000).	720	8,640	43,200	
2. Salary of Statistical Assistant	140—10—280 (E. B.)—10—310—15—400 (Revised grade, Secretariat 1st Division Assistant) Government of India.	225	2,700	13,500	The present incumbent will be drawing Rs. 200 per mensem from 5th June 1935 and his first increment will fall due from 5th June 1936.
3. Salary of Agricultural Assistant.	100—10—150. . . . .	125	1,500	7,500	
4. Salary of Typist and Clerk . . . . .	60—2—80—3—125 (Revised grade for routine clerk, Government of India).	86	1,032	5,160	The present incumbent is drawing Rs. 75 per mensem since December, 1932.
5. Salary of Duftari . . . . .	15— $\frac{1}{2}$ —20—1—30 . . . . .	16	192	960	
6. Salary of Peon . . . . .	15 . . . . .	15	180	900	
7. Travelling allowance to Statistician and Staff.	....	..	2,000	10,000	
8. Provident Fund for Statistician and Staff.	(1/12 of salary), . . . . .	..	1,181	5,905	

<b>9. Contingencies—</b>				
(a) Typewriter (non-recurring).	....	..	500	500
(b) Contingencies . . .	....	..	500	2,500
<b>Total for five years .</b>	....	..	..	90,125

This will be subject to cut if the Government of India continues it after December, 1935.

## APPENDIX XX.

NOTE DATED THE 10TH FEBRUARY 1935, BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT NOS. 13 & 14 :—APPLICATION FROM THE GOVERNMENT OF BOMBAY FOR A GRANT OF RS. 29,070 SPREAD OVER THREE YEARS FOR A SCHEME OF RESEARCH IN APICULTURE BY MR. C. J. GEORGE, PROFESSOR OF BOTANY, WILSON COLLEGE, BOMBAY. APPLICATION FROM THE GOVERNMENT OF BARODA FOR A GRANT OF RS. 16,900 SPREAD OVER FIVE YEARS FOR A SCHEME OF RESEARCH ON BEE-KEEPING FOR GUJERAT.

Reference is invited to the attached copy of a note (Enclosure I) dated the 30th July 1934 on the above subject, which was considered by the Advisory Board at its meeting held in September 1934. The Board recommended (Enclosure II) that the schemes should be referred in the first instance to a Sub-Committee of the Board, to be appointed by the Vice-Chairman to the Council, with instructions to submit its report at the next meeting of the Board. In the meantime, it was suggested that all available information on the subject with the Director, Imperial Institute of Agricultural Research, and regarding the work done at the various centres should be collected by the Council.

2. Enclosure III contains the particulars obtained from the Director, Imperial Institute of Agricultural Research, Pusa, and the Governments of Madras, Punjab, Burma, Assam, North-West Frontier Province, Hyderabad, Mysore, Cochin and Travancore. A copy of a letter dated the 13th November 1934, from Mr. C. C. Ghosh, Entomologist, Burma, who was connected with the original experiments at Pusa, containing his personal views on the 2 schemes will also be found in this Enclosure.

3. The Vice-Chairman to the Council will appoint an *ad hoc* Sub-Committee at the time of the Advisory Board meeting which will examine the two applications in the first instance.

The Sub-Committee will meet on some convenient day at the time of the next meeting of the Advisory Board which will be held at New Delhi from the 18th to the 23rd February 1935, and its report will be submitted to the Board in due course.

## ENCLOSURE I.

IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ADVISORY BOARD,  
TENTH MEETING, SEPTEMBER 1934.

SUBJECT No. 17 & 18.

- (1) APPLICATION FROM THE GOVERNMENT OF BOMBAY FOR A GRANT OF RS. 29,070 SPREAD OVER THREE YEARS FOR A SCHEME OF RESEARCH IN APICULTURE BY MR. C. J. GEORGE, PROFESSOR OF BOTANY, WILSON COLLEGE, BOMBAY.
- (2) APPLICATION FROM THE GOVERNMENT OF BARODA FOR A GRANT OF RS. 16,900 SPREAD OVER FIVE YEARS FOR A SCHEME OF RESEARCH ON BEE-KEEPING FOR GUJERAT.

Attention is invited to the attached letters (and enclosures), (1) from the Government of Bombay, No. 1762-A./33, dated the 8th February 1934, (Annexure I) and (2) from the Director of Agriculture, Baroda, No. 5906, dated the 26th June 1934 (Annexure II) forwarding the schemes mentioned above.

2. The Bombay scheme which is for a period of three years involves recurring expenditure of Rs. 24,180 and non-recurring expenditure of Rs. 4,890, or, a total of Rs. 29,070. It should be noted that the Government of Bombay undertake no financial responsibility for the scheme and that the receipts and recoveries included in the estimates are problematical.

3. The Baroda scheme is for a period of five years and involves, so far as the Council is concerned, a cost of Rs. 16,900 spread over that period.

4. The applications are for the consideration of the Advisory Board. In this connection, the attached extract (Annexure III) from the proceedings of the Board's

meeting held in January 1931, relating to a scheme (Appendix XX, printed proceedings, January 1931) submitted by the Imperial Entomologist, Imperial Institute of Agricultural Research, Pusa, for the development of bee-keeping in India, which was rejected by the Council, will be of interest to the Board.

CHARAN DAS,

*Secretary.*

*The 30th July 1934.*

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ANNEXURE I.

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COPY OF LETTER FROM THE SECRETARY TO THE GOVERNMENT OF BOMBAY, REVENUE DEPARTMENT, TO THE SECRETARY TO THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA, No. 1762-A./33, DATED THE 8TH FEBRUARY 1934.

SUBJECT:—*Research Scheme, Imperial Council of Agricultural Research, Application for grants from, for —.*

In continuation of my letter No. 1762-A./33, dated 11th January 1934, I am directed by the Government of Bombay (Transferred Departments) to forward a scheme of research in apiculture by Mr. C. J. George, Professor of Biology, Wilson College, Bombay. The scheme was approved by the Provincial Agricultural Research Committee at a meeting held on 13th December 1933. The scheme is not one pertaining to the Agricultural Department in this Presidency. The Government of Bombay will not, therefore, be prepared to undertake any financial liability on account of the cost of the scheme. If the scheme is approved by the Imperial Council of Agricultural Research, the Director of Agriculture or any officer deputed by him, will undertake to inspect the work under it and will submit an independent report on the result of such inspection to the Advisory Board.

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FROM C. J. GEORGE, M.A., PH.D., D.I.C., PROFESSOR OF BIOLOGY, WILSON COLLEGE, BOMBAY; TO THE SECRETARY, AGRICULTURAL ADVISORY COMMITTEE, AGRICULTURAL COLLEGE, POONA, THROUGH THE PRINCIPAL, WILSON COLLEGE, AND THE REGISTRAR, UNIVERSITY OF BOMBAY.

I have the honour to submit herewith an application for a total grant of Rs. 29,070 for five years from 1934 to 1939 from the funds of the Imperial Council of Agricultural Research in aid of research in Apiculture in the Bombay Presidency.

In this connection I may submit for your information a short account of my entomological experience which will indicate my competence to undertake and supervise this proposed research work. My general educational qualifications include an M.A. degree from Madras, a Ph.D. and D.I.C. from London. I have seven years' experience in entomological work at the Agricultural College, Coimbatore, and since 1930 have been an examiner in Agricultural Zoology for the Madras University. My contribution to the science of Entomology has been well received in scientific circles and my standing as an Entomologist will be evident from the fact that my work has been incorporated in the "Recent Advances in Entomology" and in the "Text Book of Entomology" by Dr. A. D. Imms, F.R.S. In 1924 I got interested in Agriculture and have been devoting some time to that subject. While at Coimbatore I studied the life-history, bionomics and metamorphosis of *Melipona*, the stingless bee, and a paper on the subject was submitted to the London University as part of my thesis for Ph.D. During my stay in England I spent some time at the Rothamstead Experimental Station and among other things gained more experience in Apiculture. Since last year I have been keeping some hives of *Apis indica* in Bombay for study. I spent last mid-summer holidays at Coimbatore and visited the two Apiaries, one at the Agricultural Station, and the other at the Y. M. C. A. Rural Reconstruction Centre. The Assistant in charge of the Apiary at the Agricultural College, Coimbatore has prepared a short Bulletin based on the available information and the work was placed in my hands for suggestions and criticism, and I understand from him it is now sent for publication.

## A SCHEME OF RESEARCH IN APICULTURE.

## I.—INTRODUCTION AND HISTORICAL BACKGROUND.

Apiculture as a side line industry to Agriculture is practised in many countries. In some of these countries the industry is carried out on a large scale. Figures are not available on the output of honey for all these countries, but it is well known that thousands of tons of honey are exported by Canada, Australia and the United States of America. Though the possibilities of apiculture in India have received the attention of Government as early as 1883 when, as a result of an enquiry Government of India published the replies from local Governments under the title "A Collection of Papers on Bee-keeping in India", the industry is still in an infant state in India. One of the early attempts at culturing bees on scientific lines was made by the Agricultural Research Institute, Pusa. In 1910 and 1911 the Institute imported some colonies of the European bee. Later Mr. T. Bainbrigge Fletcher, Imperial Entomologist, published two articles on bee-keeping in the Agricultural Journal of India. Vol. VI, Part IV. A further consolidated account came out in 1914 as Bulletin No. 46 of the Agricultural Research Institute, Pusa.

During the years 1911-1916 Father Newton, S.J., conducted trials on the cultivation of the Indian bee *Apis indica*. His results were published in an article in the Agricultural Journal of India, 1917. The Department of Agriculture, Mysore began the study of Apiculture with the Indian bee about ten years ago and have made good progress. Mr. S. J. Baldrey attempted culture of the Italian bee at Narasapur during 1926-1929. An account of his experience was published in the "Times of India Illustrated Weekly", dated 7th December 1930, 28th December 1930, 15th February 1931 and 22nd November 1931. Recently the Rural Reconstruction Branch of the South Indian Y. M. C. A. has taken up Apiculture (culture of *Apis indica*) with a view to popularise it among the Indian farmers. They have their centres at Coimbatore which is subsidised by the District Board and at Marthandam (Travancore). They have distributed so far over a total of 500 hives amongst the villagers. They help the villagers in finding a sale for their honey. They have now extended their work to the Indian States of Hyderabad and Baroda. The cultivation of the Indian bee has also been attempted at the Agricultural College and Research Institute, Coimbatore. At present the Entomological Section keeps about 30 hives and a qualified assistant is in charge of this work. I have no knowledge of the work in other provinces, but I understand that some other provinces like the Punjab are trying to popularise bee-keeping amongst the cultivators.

## II.—OUR PRESENT KNOWLEDGE OF THE INDIAN BEE.

On the question of the culture of the Indian bee, Mr. Baldrey and even the Pusa Bulletin strike a sceptic note. The attempts at culture cited above, however, have shown that the doubts raised are groundless and that the failures were due probably to imperfect technique. I have first hand knowledge of the work at Coimbatore and I have had a discussion recently with the Government Entomologist, Mysore. The data collected at both these centres are definite and the future is promising.

Mr. Baldrey, after a few years' attempts at cultivating European bees, abandoned his apiary and left for England. His hives and equipments were handed over to the Y. M. C. A., Coimbatore. At the time of my visit during the month of May, the Y. M. C. A., Coimbatore, had four hives of this bee. From my experience of bees, I cannot say that these bees are any way thriving. The Y. M. C. A. has a few more colonies of the European bee including a colony of the well-known Carnolians. These hives appear worse than the Baldrey ones. The Baldrey hives, though they were brought to Coimbatore two years ago, the Secretary in charge told me that they have not yet yielded any honey. The records of the Indian bee of the same age are more satisfactory though it is a poor honey yielder compared to the other. The Indian bee is a smaller insect than the European bee and it is usually conceded that the latter is far superior to the former in the honey yield. But it has not been established that weight for weight the European bee is superior to the Indian. Even granting that it is so in its native environment, its records so far, in the plains of India, are far from satisfactory. With proper culture and facilities and pasture, the Indian bee could be made to yield a moderately good quantity of honey. The hives of Indian bees are necessarily to be small, but provided sufficient pasturage is available (for after all it is the pasturage that determines the honey flow) the smallness in size could be made up in numbers. From my observations I find that the Indian bee is as industrious as the European bee. The Indian bee has, however, two things in its favour. It is the native of the soil and is free from diseases to which its European cousin is subjected. The only enemy is the wax moth, but with proper care its invasions could be avoided. The

record at Coimbatore and Bangalore shows that *Apis indica* is capable of yielding about 15 lbs. of honey per annum per hive. A farmer keeping 30 hives gets about 300 lbs. of honey per annum with proper care, and at a modest rate of Rs. 1 per pound his income will be Rs. 300 per annum.

### III.—THE SCOPE OF APICULTURE IN BOMBAY.

Except the unsuccessful attempt of Mr. Baldrey and a few isolated attempts such as those of the Agricultural Station at Sangli, no organised effort at Apiculture has been made in the Bombay Presidency. That the Bombay Presidency offers extensive tracts of pasture for bees is undoubted. All over Deccan *Apis dorsata* alone is found and some quantities of honey and wax are collected annually. It is estimated from the experience at Coimbatore that an acre of cotton (Cambodia) yields about 20 lbs. of honey. The Bombay Presidency has extensive cultivation of cotton at Dharwar and Gujarat, and enormous quantities of honey are therefore going to waste every year, the honey collected from *Apis dorsata* colonies being negligible. Through bee-keeping this valuable food which is otherwise lost to the country could be redeemed. The Royal Commission on Agriculture has found that the diet of the Indian ryot was miserably poor and recommended that efforts should be made to enrich his meal. Organised Apiculture in addition to adding to his income is one of the ways of meeting this end.

### IV.—SCOPE OF RESEARCH ON APICULTURE IN INDIA.

Scientific work is the backbone of any industry. Any organised attempt in introducing Apiculture in the villages could be possible only after acquiring sufficient scientific information about it. Haphazard rushing in is bound to be a failure. Even if it will be successful temporarily, before long, the industry will come to a stand-still and progress will be impossible. In all advanced countries this is sufficiently recognised and Apiculture would not have come to its present flourishing condition but for the arduous labour of those engaged in research. The following five paragraphs deal with the absolutely minimum information required before advocating Apiculture in any locality.

### V.—LINES OF INVESTIGATION.

#### A—Bionomics.

(1) *Life History*.—Our knowledge of the life history of *Apis indica* is fragmentary. A detailed all-round investigation on the life history and bionomics is therefore essential. Investigation into the longevity of the worker and the queen, the fecundity of the queen and the factors affecting swarming have direct bearing on the economics of Apiculture. The prevailing impression is that the worker of the Indian bee does not live as long as that of *mellifica*. A similar opinion is current regarding the fecundity of the queen of the former. Under domestication and culture the quality of bees is likely to improve and for a proper appreciation of the changes which will manifest as a result of culture, a thorough knowledge of the existing conditions is essential. A grasp of the bionomics will lead to ways and means of extending the longevity of the workers and possibly the fecundity of the queen.

The phenomenon of swarming also requires careful investigation. The swarming tendency is somewhat bred out of the Italian bee. The Indian bee is still primitive and is a slave to that instinct to a remarkable degree. Swarming is essential for the propagation of colonies but to the bee keeper it amounts to a nuisance, when as a result of successive swarming fairly strong colonies dwindle into handfuls of bees. The Apiculturist's work is both extensive as well as intensive. Swarming is a serious handicap to intensive culture. During the season a fairly strong colony of the Indian bee sends out as many as six swarms, the interval between two successive swarms being not more than ten days.

One of the methods at present practised to prevent swarming is the removal of queen cells. This is a difficult task as bees resent this operation very much and sting badly at the time. An easier method advocated is the use of reversible frames. This may not assure great success though it acts quite a palliative, as suitable locations will not then be available for erecting queen cells. Crowding is said to react on the bees in such a way as to send out a swarm. Provision of more space at the time is said to prevent swarming. How to bring out more space is a problem which requires some attention. A proper understanding of the different issues concerned in this mysterious response to an instinct will eventually lead to the solution of this knotty problem.

(2) *The Hive*.—Workers are divided in their opinion as to the size of the hive suitable to the Indian bee. The Pusa Bulletin advocates a hive as big as a kerosene box. The experience at Coimbatore is that a smaller hive is more suitable and that a fairly big one is one of the causes of desertion. Further, a big hive may have some frames unoccupied and may lead to wax moth attack. The Mysore Department of Agriculture adopts a hive intermediate in size between Coimbatore and Pusa patterns. The Y. M. C. A., Coimbatore, has one of Gosh pattern hives which house a fairly big colony and apparently there is nothing wrong so far. In the face of such varied experience it is essential that systematic study of the size of hives should be undertaken. Probably the size of the hive should vary with localities, and local conditions, such as weather, availability of food, etc., will determine the size required for that locality.

(3) *Pasturage*.—Very little is known about the pasturage of the Indian bee. In itself it forms a fairly big field for study. Sometimes they seem to collect honey from all kinds of flowers. At other times they restrict themselves to a few. The mango flower produces honey, in fairly large quantities, but the bees do not care for the honey, though they go to the extent of collecting the honey from the mango hopper, a Jassid bug which attacks mango flowers. Statistics of bee pasturage and the comparative honey yield of different flowers, and the relative preference shown to them by bees require thorough investigation before maximum honey yield could be obtained from any particular locality. When this study is completed it will be possible to know with fair accuracy the honey flow from different flowering crops and after the main flow is exhausted, the resources from other flowers, if available, in other sites could be tapped. In this way a scheme of rotation could be worked out for all localities. For example, round about Coimbatore the cotton season is from January to April. The pasturage after this time will be sparse for about three or four months. The tamarind, another good yielder, flowers in April but it occurs only in isolated places and the hives of the Government Entomologist are therefore shifted to suitable sites where the tamarind will be available. Pongamia plants flower at Dharwar after the cotton season and will easily be a second pasture for bees. The same story holds good for pollen also. A full scheme of rotation if worked out for particular localities will simplify bee-keeping to a great extent. We cannot expect the Indian ryot to undertake such a study and many years will elapse before he attains that standard.

(4) *Seasonal variation in honey flow and yield*.—Coupled with the above study, a daily record of the weight of the hive and the temperature will be very illuminating. The weight of the hive is an index to its prosperity. The bees' response to the seasons will be clearly indicated in this record. The effect of artificial feeding when food supply is scarce will also be reflected in this record. Bees die in large numbers during the monsoon time. The temperature readings will throw some light on this fatality during the months of the monsoon. It will be premature to foretell how this study will be of importance in understanding clearly the domestic happenings and thereby to assess the prosperity of the colony, but we hope that when sufficient facts are gathered, they will facilitate working out the economics of bee-keeping.

(5) *Suitable localities*.—One of the foremost things in starting Apiculture is to select suitable localities which will form the venue of operations. Bees require both honey and pollen and the localities selected should provide both. Our experience is that bees collect honey from a host of plants, the more important of them are Cotton, Plantain, Tamarind, Pongamia, Coconut, etc. The more important pollen supplying plants are the grainaceous plants like Zea mays, Andropogon Sorghum, Pennisetum typhoideum and also Cocos nucifera, Ricinus communis, etc. Pasturage is one of the aspects of bee-keeping in India which invites thorough investigation and till fuller data is available such sites as will provide a fair amount of honey and pollen should be selected for starting the experiments. Experience in this direction will tell us which tracts will be suitable for Apiculture and which tracts not.

#### B—Breeding and Culture.

It is usually understood that the European bee is a superior honey gatherer and breeder on account of its bigger size. The European bee does not appear to be very successful in India. It is therefore worth while attempting to evolve a hybrid between the Indian and the European or Italian bee so as to combine the good qualities of both. This work requires a good deal of skill in technique and could be attempted only after acquiring a sound knowledge and experience in bee-keeping as well as in the Economics of both those species. It will therefore be too early to dilate at any length on this aspect of the programme at this stage. Experience in Apiculture in Egypt shows that the Egyptian bastard, a cross between Egyptian and Italian bees, does very well in that country. Provision for the purchase of Egyptian and Italian swarms and queens is included in the proposed expenditure of the year 1935-36.

There are two varieties of the Indian bee, a dark and a light one. The dark one inhabits usually the higher altitude whereas the light variety is prevalent in the plains. It is reported that the darker variety is a better honey yielder. This has to be verified. By persistent selection and improved cultural methods, it will be possible to increase the efficiency of our bees. Every effort should be made to improve the bees in this direction and after sufficient work is done, strains of bees (light or dark variety) will be available for distribution amongst cultivators.

*C—Introduction of foreign plants as pasturage to test if bee-keeping will be remunerative on a commercial scale.*

Three foreign crops which are likely to prove promising in Apiculture are Buckwheat, Corean Lespezeda and White Clover. The honey yielding quality of these plants is well known. They are also valuable either as grain or as fodder. The second of these, the Corean Lespezeda, is a xerophyte and can stand even severe droughts. Apart from an Apicultural standpoint the introduction of this plant is likely to prove beneficial in the Deccan where rainfall is limited. The first two plants are at present cultivated at the Rural Reconstruction Centre, Vadala Mission, Ahmednagar District (American Marathi Mission) and appear to be suitable for our soil. It is proposed that these three plants should be tried as honey yielders. The information gained will show how far it is going to be a paying concern to cultivate these plants for purposes of Apiculture. For this purposes each crop should be cultivated on areas not less than two acres. To ensure a standing crop of two acres under each crop, allowing sufficient rotation of crops, the minimum land required will be ten acres. A suitable piece of land about ten acres in extent is available, to be taken on lease or rent, near the Vadala Mission. The owner demands a rent of Rs. 100 per annum. It is a suitable piece of land. There are three wells which will be sufficient to meet the irrigation requirements. The proximity to the Agricultural Station enables to hire cattle, implements and labour from the Station. The Principal of the Vocational School at the Rural Reconstruction Centre has very kindly consented to render all facilities in this connection.

#### VI.—SCHEME.

The Scheme as outlined deals only with the preliminary aspect of Agricultural Research. The lines of investigation chalked out are only those of economic importance. The more difficult problems and those of purely academic interest have been left out, as they have to be undertaken only after sufficient ground is covered.

The proposed research will be conducted at three Stations, one located at Dharwar, a second at Vadala and a third at Mahim. Dharwar has been selected as it is typical of the Cotton and Juar tracts of the Deccan. Mahim has been selected as it possesses a vegetation of Coconut, Banana, etc., typical of the coastal tracts of the Presidency. Vadala is a centre of rural reconstruction work and on account of the facilities it offers in the cultivation of the foreign pasturage plants, it will be an ideal centre to concentrate on the commercial aspect of Apiculture. There is an additional attraction in the free service offered by Mr. Balaram, Vice-Principal of the Vocational School. Mr. Balaram is in charge of the Apiary at the Station and a certain amount of work on the practicability of Apiculture has already been attempted there. Any improvements carried out at that Station will be easily appreciated by the ryots of the surrounding areas and in this respect offers unique opportunities for propaganda in the event the investigation becomes fruitful.

Though regarding certain aspects the three Stations will work on common ground, it is proposed that each Station should concentrate on a few specific aspects of the Scheme. The Mahim Station, apart from studying pasturage, swarming, etc., will devote special attention to the bionomics, life history and the size and nature of the hives. The Vadala Station will attempt hybridization with Italian and Egyptian bee and on the honey yielding qualities of the foreign crops, and thereby work out the commercial aspect of the same. The Dharwar Station will see how far the Cotton tracts will be useful in honey production and devote more attention to the suitability of the Egyptian bastard to our conditions. It will make a thorough survey of the pasturage of Deccan.

The Director of Agriculture, Bombay, has been so kind as to grant permission to open the Dharwar Station on the premises of the Cotton Research Station. He has also promised the co-operation and assistance of the officers connected with the Station. As Dharwar has only low rainfall the hives could be located under the shade of the trees on the Station and from experience I find that it is better than placing them under a roof. A small store room will have to be rented on the premises from the Public Works Department. The Deputy Director of Agriculture, Dharwar, informs me that the rent will not exceed Rs. 4-2-0 per mensem.



The Station at Dharwar should be placed in charge of an Assistant who should be a Biology graduate with experience in handling bees. There should be an Attender to assist him. The pay proposed for the Assistant to be posted at Dharwar is in the scale of Rs. 100—10—200 and for the Attender at Dharwar Rs. 25 per month.

The Vadala Station will be in charge of Mr. Benjamin Balaram. He should be assisted by an Attender on Rs. 25 and a gardener and a servant boy on Rs. 10 and Rs. 5 per month respectively. A room for work and for keeping the equipments will have to be rented out from the Agricultural Station for a rental of Rs. 50 per annum. The Principal has promised all possible assistance in working out the Scheme.

The Mahim Station will be directly in my charge and will be in a private garden where facilities for keeping the hives and the equipment could be rented out. There should be an Attender to assist me on Rs. 40 per month.

The number of hives at the Mahim Station should be, to begin with, nine—six of the Indian bee and three of the Egyptian bee. The Vadala Station should have fifteen hives of the Indian bee, five of the Italian and five of the Egyptian bee. The Dharwar Station should have fifteen hives of the Indian bee and five of the Egyptian bee. In the succeeding years the hives will increase in number on account of swarming. Spare hives will have to be purchased every year from the allotment under contingencies.

#### VII.—STATEMENT OF ESTIMATED EXPENDITURE.

The following is a statement of proposed expenditure:—

<i>Recurring—</i>			For five years.
<i>Salaries—</i>			Rs.
Assistant at Dharwar in the grade Rs. 100—10—200 per mensem . . . . .			7,200
Attender at Dharwar on Rs. 25 per month . . . . .			1,500
Attendance at Vadala on Rs. 25 per month . . . . .			1,500
Gardener and Servant boy at Vadala on Rs. 10 and Rs. 5 per mensem . . . . .			900
Attender at Mahim on Rs. 40 per month . . . . .			2,400
		Total of salaries . . . . .	13,500
<i>Travelling allowance—</i>			Rs. A. P.
For the Officer in charge of the scheme—			
From Bombay to Ahmednagar and back : Railway fare $1\frac{1}{2}$ second class, i.e., $1\frac{1}{2} \times$ Rs. 26 . . . . .	39	0	0
Mileage from Ahmednagar to Vadala and back at 4 annas per mile, i.e., 27 miles and 27 miles = 54 miles $\times 4 = 216$ annas, i.e. . . . .	13	8	0
	52	8	0
	Per trip . . . . .		
In round figures per trip Rs. 53.			
For five trips in the year Rs. 53 $\times 5$ . . . . .	265	0	0
From Bombay to Dharwar and back : Railway fare $1\frac{1}{2}$ second class, i.e., $1\frac{1}{2} \times$ Rs. 56 $\times$ Rs. 84-0-0 . . . . .	420	0	0
For five trips in the year Rs. 84 $\times 5$ . . . . .	420	0	0
Halting allowance for visiting these Stations 40 days in the year at Rs. 3-8-0 per day, i.e., 40 = Rs. 3-8-0 . . . . .	140	0	0
Daily allowance for visiting the Mahim Station 90 days in the year at Rs. 3-8-0 per day, i.e., 90 $\times$ Rs. 3-8-0. (Mahim is 10 miles from Bombay). . . . .	315	0	0
Total travelling allowance for the Officer in charge per year . . . . .	1,140	0	5,700
For the Officer in charge at Vadala—			
Visit to Dharwar Station once a year : Railway fare from Ahmednagar to Dharwar and back $1\frac{1}{2}$ second class, i.e., $1\frac{1}{2} \times$ Rs. 56 . . . . .	84	0	0
Mileage from Vadala to Ahmednagar and back at 4 annas a mile—56 miles . . . . .	13	8	0
Halting allowance for 4 days at Rs. 3-8-0 . . . . .	14	0	0
Total travelling allowance for the Officer at Vadala per year (in round figures) . . . . .	112	0	560
	Total of travelling allowance . . . . .		6,260

urring—contd.	For five years.	
Contingencies—	Rs.	Rs.
For Dharwar—		
Rent for Station per annum . . . . .	50	
Other incidental expenses including purchase of spare hives, small apparatus, stationery, correspondence, etc., etc. . . . .	150	
Total per year	200	1,000
For Vadala—		
Cultivation expenses including purchase of seeds, irrigation, ploughing, etc., per annum . . . . .	200	
Rent for 10 acres of land . . . . .	100	
Rent for laboratory . . . . .	50	
Other incidental expenses including purchase of spare hives, stools, correspondence, etc. . . . .	150	
Total per year	500	2,500
For Mahim—		
Rent for the Station per annum . . . . .	94	
Other incidental expenses . . . . .	100	
Total per year	184	920
Total of recurring contingencies . . . . .	..	4,420
 <i>Non-recurring—</i>		
Purchase of Indian bees—		
For Dharwar . . . . . 15 hives		
For Vadala . . . . . 15 hives		
For Mahim . . . . . 6 hives		
		Rs.
at Rs. 20 per hive for 36 hives . . . . .		720
Transport charges for the hives from Coimbatore or Travancore or both . . . . .		200
Purchase of Italian bees—5 swarms for Vadala with spare Queens and transport charges at Rs. 150 . . . . .		750
Purchase of Egyptian bees—		
For Dharwar . . . . . 5 swarms		
For Vadala . . . . . 5 swarms		
For Mahim . . . . . 3 swarms		
13 swarms		
with spare Queens and transport charges at Rs. 150		1,950
Total for purchase of bees . . . . .		3,620
 Purchase of apparatus and equipment—		
Shed at Vadala honey extractors, thermometers, etc., for three Stations . . . . .		570
Binocular microscope for the Vadala Station . . . . .		500
Apparatus for insemination . . . . .		200
Total for apparatus and equipment		1,270
Grand total for five years . . . . .		29,070

Year.	Recurring.			Non-recurring.
	Salaries.	Travelling allowance.	Contingencies.	Contingencies.
	Rs.	Rs.	Rs.	Rs.
1934-35 . . . . .	2,460	1,252	884	4,890
1935-36 . . . . .	2,580	1,252	884	..
1936-37 . . . . .	2,700	1,252	884	..
1937-38 . . . . .	2,820	1,252	884	..
1938-39 . . . . .	2,940	1,252	884	..
Total for five years .	13,500	6,260	4,420	4,890
Grand total for five years .	Rs. 29,070			

## VIII.—INCOME AND ASSETS AT THE CONCLUSION OF THE RESEARCH.

There will be an income from land at Vadala at least Rs. 100 per annum for five years . . . . .	Rs. 500
The income from the sale of honey of the Indian bee on a modest estimate of 4 lbs. of honey per hive at Re. 1 per lb. is expected to be for the 1st year Rs. 140 ; 2nd year Rs. 280 ; 3rd year Rs. 420 ; 4th year Rs. 560 ; and 5th year Rs. 700 ; <i>i.e.</i> . . . . .	2,100
The yield from foreign bees is not taken into account at all.	
Total income . . . . .	<u>2,600</u>

On the conclusion of the research the assets of the Stations is expected to be at least 500 hives of the Indian bee worth Rs. 10,000 and if everything goes well with the foreign bees there will be left of them 250 hives worth Rs. 37,500. If the hybridization experiments are going to be successful the hybrids will be worth double the value of the foreign bees, *i.e.*, Rs. 300 per hive.

Even if the Italian or the Egyptian bee does not thrive satisfactorily and the hybridization attempts prove to be failure there will be at least 100 hives left of these foreign bees and estimating at a low figure of Rs. 100 per hive their value will be Rs. 10,000. The total value of Indian and foreign bees will therefore be at least . . . . .	Rs. 20,000
The value of the equipment at half the invested amount will be at least . . . . .	1,000
Total assets . . . . .	<u>21,000</u>
The income <i>plus</i> the assets at the conclusion . . . . .	<u>23,600</u>

The net expenditure which has to be incurred by the Council will be less than Rs. 6,000.

## ANNEXURE II.

COPY OF LETTER FROM THE DIRECTOR OF AGRICULTURE, BARODA STATE, BARODA, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA, S.W., No. 5906 OF 1933-34, DATED THE 26TH JUNE 1934.

I have the honour to send by a separate registered book post 200 printed copies of the Bee-keeping scheme to be submitted to the Imperial Council of Agricultural Research at the ensuing Advisory Board Meeting to be held in September 1934, for your perusal and circulation to the members. One printed copy is enclosed herewith for perusal.

Scheme for Research on Bee-keeping for Gujarat.

GENERAL.

Bee-keeping is one of the Agricultural Industries that have received scant attention from the public and its possibilities to provide a source of earning during spare time do not seem to have been considered seriously. The importance of honey as a valuable item of food is growing day by day, and establishment of bee-keeping as an industry by itself will surely form a very valuable measure in increasing national wealth and indigenous agricultural activities. It is also surmised that very large quantities of honey are imported from foreign countries and it is of immediate importance to take very active steps in the establishment of this industry.

Bee-keeping is well known to be very successful to supplement the cultivator's normal income. That any measure designed to investigate into possibilities of successful bee-keeping is of an all-India importance cannot be denied and it is on the following lines that information is lacking and on which research work has to be undertaken.

The manipulation of Indian bee including hive designs and trials with various local races the Indian bee (*Apis indica*) is not considered as a comparatively good honey gatherer—From about 30 to 40 lbs. of honey in the hills to about 6 to 10 lbs. honey in plains. A colony of Indian bees yield varying quantities of honey per annum and information is lacking as to the factors that influence these variations and whether the present methods of manipulation and the designs of the hives require changes to secure a better yield. Criticisms as to the unsuitability of the Indian bee are often levelled and it is to be regretted that no full knowledge of the characteristics of local races are yet available.

*Hybridisation with local races and varieties with a view to secure a strain of higher honey yielding capacity and less swarming impulse.*—It is often expressed that the Indian bee has the most swarming impulse. Over a dozen reasons may be put forward to explain the incidence of this impulse, but no experiments have been undertaken to practise preventive measures. Various races of bees possess varying degrees of this impulse and possibilities of hybridizing these races to secure a strain with less of this impulse have to be investigated. The rock-bee for instance is reputed to be a good gatherer and possibilities of hybridizing it with the Indian bee also require to be investigated on. With the present information, a definite opinion as to the sources of this venture cannot be given and if the work proves successful a very great impetus can be given to the starting of large scale apiaries all over India.

*Trial of local races in various surroundings having variations in pasturage with a view to ascertain the limiting factors to success.*—Bee-keeping in climatic, seasonal and pasturage conditions is of importance. The information available at present as to what plants are useful as bee-pasturage in India and how the availability or otherwise as such plants will stand as a limiting factor for bee-keeping as commercial proposition is so scanty that it is not possible to ascertain whether in a given locality bee-keeping will at all be successful. So also climatic and seasonal factors that influence honey gathering require to be carefully studied.

*Costing experiments with cultivated pasturage and money yield to see if the former could be profitably carried out in localities where there is a lack of natural pasturage or where there is only one flowering season.*—In certain localities on account of incidence of one monsoon, there exists only one flowering season and bees suffer from lack of pasturage during the rest of the year. Experiments need be conducted on the economics of certain plants whose flowers serve as good bee pasturage during the season of drought.

*A fuller knowledge of the seasonal factors that influence breeding, swarming and honey gathering.*—It is often mentioned that swarming just precedes the honey flow and swarming is preceded by breeding. Fuller information is necessary with regard to the seasonal factors that influence breeding.

## EFFORTS OF BARODA GOVERNMENT.

The Department of Agriculture of the Baroda Government has started Bee-keeping since the last four years by the introduction of bees from Coimbatore. Efforts on the line were made at the Baroda Agricultural Experimental Station and subsequently when the Rural Reconstruction work was started at Kosamba this work was handed over to that section on which the Baroda Government are spending about Rs. 20,000 per year. Local bees (*Apis indica*) are available from Baroda territory and if the local bees are experimented with, the difficulties as to double swarming, different pasturage, etc., which have been experienced might be easily dealt with. The problem of combating the deadly pest of wax moth faced gravely the problem in Baroda and this as well might be attended to. The Officer in charge of the Rural Uplift Scheme is an Expert Bee-keeper but for want of different duties he has to attend to, he could not solely give his attention to this item and a special staff for such research may help him a lot on the line.

## MAIN ITEMS OF RESEARCH.

The main items of research in this Bee-keeping which ultimately may be useful for Gujarat and other like parts are (1) Collection of local bees and studying their behaviour, manners, etc., (2) Crossing of these bees with other types in order to improve their desirable qualities, (3) Study of pasturage—artificial and natural and lastly (4) The Study and control of bee diseases and pests.

## THE SCHEME.

The Baroda Government will provide all the apparatus and material for the purpose and the Expert staff may be provided by the Imperial Council of Agricultural Research. The staff will work under the Rural Reconstruction Officer.

The following may be the establishment and other charges for the Scheme to be spread over a period of five years.

## RECURRING EXPENDITURE.

	I.	II.	III.	IV.	V.	On an average.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1. A Bee-expert Rs. (150—15—25).	1,800	1,980	2,160	2,340	2,520	2,160
2. A non-graduate or graduate assistant Rs. (50—5—75).	600	660	720	780	840	720
3. Travelling Ex- penses.	500	500	500	500	500	500
	2,900	3,140	3,380	3,620	3,860	3,380
Total Rs. 16,920						

Non-recurring expenditure such as Office dead-stock, management, apparatus, appliances, etc., might be arranged through the Agricultural Department of the State.

Average pay may be allowed to suitable persons if necessary.

## ANNEXURE III.

*Extract from the proceedings of the Advisory Board, January 1931.*

“Dr. Keen in introducing the scheme said that if it was desired to develop bee-keeping in India the way suggested in the scheme of the Imperial Entomologist was the way to do it, but Dr. Keen had no knowledge of the demand in the country and he thought that the Board should be guided in this matter by the views of representatives of the provinces. He also thought that it would be very difficult to get the right type of man to take the charge of this scheme. Dr. Hyder supported the scheme on the ground that it might lead, if successful, to the establishment of a cottage industry

in India. The Royal Commission on Agriculture had stressed the importance of the development of cottage industries in India. Professor Agharkar said that he was diffident about the scheme as outlined. He saw that Rs. 20,000 per annum had been provided on account of the cost of the officer and Rs. 10,000 for other items of expenditure and he considered the total cost excessive. He was also not in favour of appointing the expert from abroad who would go away after three years with all the accumulated knowledge gathered by him which would be lost to India. If there was scope for the development of bee-keeping in India he thought a better course would be to send a promising student abroad with a scholarship who on his return could tackle with the subject. Mr. Plymen said that bee-keeping was not a matter of general importance in India and he was therefore not particularly keen on this scheme. He thought that the problem of bee-breeding should be one of the problems which should be referred for investigation to Universities with the help of a small grant. Mr. Collins said that he thought the scheme was too expensive. The bee-industry in India was not likely to become a cottage industry in the plains owing to climatic conditions. Flowers grew in India all the year round and there was therefore no incentive such as they had in colder climates for bees in India to store their honey except in very limited areas. If, however, it was desired to investigate the question he would suggest either, as Dr. Agharkar had proposed to send a student from India with a scholarship abroad or, as Mr. Plymen had recommended to add it to the list of problems which would be referred to Universities for a grant. Mr. Burt said that the economic problem should be kept separate from the technical. He did not think that on present information there was sufficient justification for the view advanced by Mr. Collins that India was not a suitable place for bee-keeping. It might be that if the right type of bee was obtained a cottage industry might be established. The question which they had to decide was whether bee-keeping was worth while. If the answer was in the affirmative then he would support the adoption of Dr. Agharkar's proposal to send a student abroad with a scholarship for training instead of importing an expert from abroad. Mr. Carpenter in opposing the whole scheme said that its annual cost was Rs. 30,000. The Board had been informed that for this amount three Animal Nutrition Sections could be run in the provinces. There was no question as to the relative importance of the two. This was only an example. In his opinion there were many much more important problems both in agriculture and animal husbandry than bee-keeping to which the Council could profitably devote its funds.

The Board did not recommend the scheme for sanction".

## ENCLOSURE II.

*Extract from the Proceedings of the Advisory Board held in September 1934.*

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Application from the Government of Bombay for a grant of Rs. 29,070 spread over three years for a scheme of research in Apiculture by Mr. C. J. George, Professor of Botany, Wilson College, Bombay. (Subject No. 17 on the agenda).

Application from the Government of Baroda for a grant of Rs. 16,900 spread over five years for a scheme of research on Bee-keeping for Gujerat. (Subject No. 18 on the agenda).

As these two items related to the same subject they were taken together. Dr. Burns and Mr. Sane introduced the Bombay and Baroda schemes respectively. Dr. Burns said that this scheme was important in view of the fact that bee-keeping would be an useful subsidiary industry for agriculturists. Professor George was fully qualified to carry out the scheme. Mr. Ramamurthy said that in Madras a considerable amount of work on bee-keeping had been done both at the Agricultural College and by the Y. M. C. A. and that they were publishing a bulletin specially devoted to bee-keeping. He also said that the Mysore Government had started work on bee-keeping and that bee-keeping was recognised as a valuable cottage industry. He therefore suggested that before undertaking these two isolated schemes the Board might get all the information that was available in the various centres where work was being done so as to see what problems had already been solved and what remained to be done and then place all the information collected before a Sub-Committee to be appointed to determine what problems remained to be solved. These two schemes might also form material for that Sub-Committee. Mr. Richards, in supporting the suggestion made by Mr. Ramamurthy said that after all the question whether

bees could be kept profitably in any province or in any area of a province depended upon the flora of the province at the time being and that information could be obtained with very little expense. The question of bee-keeping in India, however, appeared to him to be one which could best be dealt with by having one Central organisation to deal with essential investigations. Experiments had to be carried out on the importation of bees from abroad. The matter required a very careful handling especially because of the diseases that might be brought in which the imported bees and such hybridisation as may possibly be done with the imported bees and the indigenous Indian species. All these matters required the constant attention of a permanent establishment and expert assistance over a long period of time. He therefore thought that the work required to be done in the provinces could best be done by such a Central organisation where all the major work could be carried out and from which provinces could draw their supplies. Mr. Burt agreed with Mr. Ramamurty and said that the matter should be referred to a committee for consideration as to what was to be done in the way of research from an all-India point of view. He also said that the Imperial Entomologist should be requested to furnish any fuller detailed information on the subject which might be available. He thought there was a lot of information available at Pusa. Mr. Ritchie agreed with Mr. Richards and suggested that men from the provinces could be trained at a Central Station. Messrs. Davadhar and Likhite however pressed for the immediate starting of these two schemes. Dr. Burns accepted the suggestion of Mr. Ramamurty. The Board decided on the appointment of a Committee and to refer the schemes to it. The selection of the personnel of the Committee was left to the Chairman of the Board. The Committee should submit its report to the next meeting of the Board.

### ENCLOSURE III.

NOTE BY THE IMPERIAL ENTOMOLOGIST, IMPERIAL INSTITUTE OF AGRICULTURAL RESEARCH, PUSA, DATED THE 13TH NOVEMBER 1934 ON BEE-KEEPING IN INDIA.

There is a great deal of demand for pure honey in India, and there is no doubt that this demand is not being met by the local produce, inasmuch as every year a large quantity of this valuable article of diet is imported from foreign countries. Honey bees occur in almost all parts of India and in view of the fact that a very rich flora exists in this country, there is no reason why India should not be able at least to meet its own requirements of honey. Moreover it appears that Indians are becoming fond of keeping bees, as the number of enquiries received at Pusa about apiculture has steadily increased during the last five years.

Of the three important species of honey bees which occur in India, two, namely, *Apis dorsata* and *A. florea*, on account of their peculiar habits are not suitable for domestication. The third, *A. indica*, is the only one which can be cultivated with advantage. As reported by dealers in Calcutta, the honey produced by this bee at Pusa was as good in quality as the best foreign stuff. But as compared with the Italian bee, *A. mellifica*, the Indian bee is more prone to swarming and yields much less quantity of honey. However, in view of the fact that the yield of this bee varies greatly (5 lb.—20 lb.) in the various parts of India, depending on climate, it is perhaps possible that this bee has potentialities of much higher yield if it is cultivated under suitable climatic conditions. It is known that the Indian bee thrives better in the hills than in the plains of India, but the accurate determination of the conditions under which this bee can flourish best and yield maximum quantity of honey requires further research work.

The exact nature of the pasturage of the Indian bee is also yet not fully known. All flowering plants do not constitute bee pastures and the pasturage of one bee may be different from that of another. Moreover, a plant which gives nectar to a bee under one climate may not do so under different climatic conditions. It is therefore essential that for the proper cultivation of the Indian bee its pasturage must be accurately determined.

The Italian bee has not been given a fair trial in this country. It was reared successfully at Pusa for some time, but at the time of swarming all the young queens got eaten by predaceous enemies and the colony thus came to an abrupt end. But by the modern technique of artificial insemination it should be possible to avoid such a catastrophe in future.

The Italian bee has been cultivated at one or two places in South India for several years but sometime ago the most successful and expert keeper of this bee

in that area (one Mr. Baldry) left his apiary and went away to England. Both at Pusa and in South India, the Italian bee yielded much less honey than the normal quantity. This was most probably due to the fact that the bee had not yet got acclimatized to the Indian conditions and in my opinion not due to the adverse climatic conditions of this country, inasmuch as this bee has been successfully introduced in such widely distributed countries, such as Europe, Africa, Australia, New Zealand, etc.

In reference to the Italian bee I may emphasize that this bee should be introduced into India with great caution. It is susceptible to certain serious diseases from which India is so far free.

As in the case of the Indian bee, no research work has been done to determine the exact conditions under which the Italian bee can thrive best in this country.

Moreover, no work has so far been done in India on the crossing of the Indian bee with Italian or Egyptian bee with a view to evolve a strain which may be without the qualification of the former bee. Thus the question of bee keeping in India is very big indeed. It is an all India question and requires to be studied by a wholtime man, who shall have to work for a large number of years before the industry can be established on scientific footing. The man, in addition to being a good general entomologist must have practical experience of bee-keeping. A mere bee-keeper, howsoever experienced will not do, as the proper study of the question requires thorough knowledge of the fundamental principles of insect biology. No doubt, a man with the qualifications mentioned above does not exist in India at present. To import such a man and keep him for about 10 years will be expensive. I would suggest that the Imperial Council should recruit a promising young Indian entomologist and send him abroad for a year or so for training in bee-keeping. On his successfully completing the course, the Imperial Council of Agricultural Research must be prepared to keep him in employment for about 10 years, though the actual appointment in the first instance may be for 5 years.

I think it is a good thing that the Advisory Board has decided to refer the question of bee-keeping to a special Sub-Committee on which I presume there will be some entomologists also. Such a question of all India importance does require a very careful study before any scheme connected therewith can be successfully launched.

NOTE BY THE ENTOMOLOGIST TO GOVERNMENT, MADRAS.

I. MEMORANDUM OF EXPERIMENTS CARRIED OUT AND RESULTS OBTAINED.

1. *Technique of hiving.*—A novice finds considerable difficulty in having wild colonies. From the experience gained from hiving scores of wild colonies, an easy and sure method has been evolved which consists in capturing the queen in a small cage and then attracting the rest of the bees to the artificial hive. Observations on the favourable seasons for hiving were also made.

2. *Breeding and swarming seasons.*—The breeding and swarming seasons and the factors influencing these were studied.

3. *Pasturage.*—Cholam, maize and cumbu seem to be the best pollen yielders and next to these come *Peltophorum*, castor and garden plants such as Zinnias, Sun-flower, etc. Cambodia cotton is a good source of nectar and an acre of the crop is capable of yielding more than 10 lbs. of honey and next to this comes tamarind. Bees show a special preference to the above mentioned graminaceous plants though there may be several other plants in flower, the chief factors influencing the preference being the quantity of pollen. There is also a considerable difference in the time of visit by the bees to the various flowers.

4. *Granulation of honey.*—Attempts to granulate honey artificially were made by subjecting the samples to extremes of temperature alternately. Honey that did not granulate for nearly a year began to form crystals within 15 days of the treatment.

5. *Appliances.*—A cheap and efficient model of a honey extractor has been evolved. Very often the control of drones becomes a serious problem. An easy technique and a simple contrivance (drone trap) were devised.

6. *Economics.*—Preliminary observations go to show that a hive, under ordinary conditions, is capable of giving a net profit of Rs. 17-8-0 per annum.

The results of the work done so far in Madras have been incorporated in a Departmental Bulletin on Bee-keeping in South India and is in the press at present.



## II. ITEMS UNDER INVESTIGATION.

1. A study of the variations in the rate of egg-laying and in the duration of the life cycle with reference to the seasonal and pasturage conditions.
2. Observations on the temperature and weight of colonies.
3. Trial of honey and pollen substitutes.
4. Chemical analysis of artificial honeys.
5. Feeding habits of the wax-moth larvae.
6. Possibilities of wax extraction.
7. Trials of acclimatising the Hill bee (*A. indica*, black variety) on the plains.

## III. ITEMS PROPOSED TO BE TAKEN UP DURING THE CURRENT SEASON

1. *Swarm prevention* :—
  - (a) Demarree method.
  - (b) Reversible frames.
  - (c) Provision of additional space.
  - (d) Swarm mixing method.
  - (e) Artificial division (1 and 2).
  - (f) Requeening method.
2. Queen rearing on a large scale.
3. Quantity of nectar collected by a bee per trip.
4. Nectar yielding capacity of Cambodia cotton.
5. Study of sugar concentration in nectar in relation to the humidity.

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*Extract from a letter from the Director of Agriculture, Punjab, to the Government of Punjab, regarding work done on bee-keeping in the Punjab.*

I have the honour to say that subject to what is stated in paras. 7 and 8 below, no work has been done by the Agricultural Department on apiculture since 1918. Such efforts as have been carried out by various private individuals and by Government, prior to this date, do not appear to have met with much success.

2. Sir Louis Dane, who was keenly interested in bee-keeping and had been keeping bees in Kulu in 1883-84, started an experiment in Simla in 1908, but it was a failure because the bees could not be transferred into the frame hives. In 1909, Mr. Renouf, the then Director of Agriculture, Punjab, obtained bee hives from Pusa and appliances from England and sent them to Barnes Court, Simla, and to Mr. Brooks, the Headmaster of the Simla High School. In the same year Mr. Carson, Assistant Professor of Entomology, Punjab Agricultural College, Lyallpur, formed the Punjab Bee Keeping Association with headquarters in Simla, but the promoters got a great set back due to bad season and members lost their bees owing to excessive rains. Sir Louis Dane, however, found that the bees at Bhajji on the Sutlej, at an elevation of only 2,000 feet above sea level, gave a large outturn of honey.

3. In 1910, Mr. Carson revived the Association. He gave practical instructions to the members of the Association and also supplied them with swarms of bees. Although there is no note on record, the experiment appears to have met with little success. Sir Louis Dane also tried the experiment of acclimatising hill bees in Lahore in 1910. He came to the conclusion that even in favourable circumstances hill bees would not survive the hot weather in Lahore in frame hives, though they might be able to live in specially cold and protected positions.

4. In 1914, one Mr. F. S. Cousins was appointed Apiculturist, and he worked till March 1918. His efforts to popularise bee-keeping on modern methods did not succeed and in a note on the results of his experience, he remarked that bee-keeping as a means of livelihood would not yield great results until the introduction of Western Bees becomes possible.

5. A reference is invited to a note by Mr. Thompson, Executive Engineer, Public Works Department, Irrigation Branch, in the Agricultural Journal of India, Volume

XIII of 1918 (pages 348-51). A copy of his note giving a final account of the results is also enclosed for perusal.

6. It may be further added that a bee farm with about 50 hives was started at Raision, Kulu, by a Russian gentleman two years ago. This department has no details of the results of this farm, but it appears that the venture has not been a success for the owner is trying at present to sell his stock.

7. Bee-keeping was tried at the Rawalpindi Agricultural Station in 1931 and 1932 when efforts were made to keep wild bees from the plains, but in spite of all efforts they refused to be domesticated and after spending some time under the beams of the farm office they disappeared. They refused to make use of the improved modern bee-hives provided for them.

8. In summer 1933, efforts were made to domesticate the migrating plain bees at different altitudes in the Murree hills where improved bee-hives with wax combs were provided, but the bees refused to enter these hives except at one place—in Murree town proper. In this hive the swarm made good progress and in order to induce them to remain in their new home no extraction of the honey was allowed in that year. The bees remained in the hive throughout the winter and continued to work during 1934 as well. In the commencement of the summer of 1934, 3 more improved hives were placed at different altitudes, but the bees did not enter them. Then in place of the improved bee-hives ordinary wooden casings were provided and the bees entered at 3 places. One swarm was then transferred from the ordinary wooden casing to the improved bee-hive and seemed to work in it alright. Thus there are at present two swarms working in the improved hives—one in Murree town and the other at Bansragali and two in the ordinary wooden casings placed in the kacha walls of a zamindar's hut near Tret. No honey was extracted from them during 1934.

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COPY OF D. O. LETTER FROM MR. W. P. THOMPSON, EXECUTIVE ENGINEER, P. W. D., TO THE DIRECTOR OF AGRICULTURE, PUNJAB.

The bees did very well at the start and produced good honey. I gave them foundation in frames.

The colonies perished from attack by the wax moth. In those days I had to be absent from my head-quarters for periods of 10 to 12 days when I went on tour and the hives could not stand this interval of inattention.

I returned from a tour once to find the hives ruined by wax moth but few bees left. It was too late to do anything then.

Another weakening effect was the number of queens they had and their inclination to swarm; I did not have the experience needed to destroy the queen cells.

With more experience and better attention, there is reason to believe that success is possible.

Touring as I always have to do I have never repeated the experiment which was very interesting as long as it lasted.

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COPY OF LETTER No. 6553-D., DATED THE 26TH DECEMBER 1934, FROM THE DEPUTY SECRETARY TO GOVERNMENT, PUNJAB, DEVELOPMENT DEPARTMENT, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI.

SUBJECT :—*Work done on bee-keeping in the Punjab.*

In continuation of Punjab Government letter No. 6416-D., dated the 11th December 1934, I am directed to inform you that Mr. J. A. Ferguson, Financial Commissioner, Development, personally conducted such experiments on a fairly large scale in 1925-26 as Deputy Commissioner, Rawalpindi, and found that the bees left the gardens in the plains when the annuals died. He cannot, however, say whether this was due to the increasing heat or to the dearth of flowers in the gardens. Anyhow the results suggested that the bees were migratory and would not domesticate. It is possible that they might settle down for good at some such place at Chattar Bagh, 2,500 feet above sea level, between Rawalpindi and Murree if there were enough flowers in the garden. Sir Louis Dane's report on results at Bhajji on the Sutlej at an elevation of 2,000 feet, referred to in paragraph 2 of the enclosure to Punjab Government letter No. 6416-D., dated the 11th December 1934, suggests that an experiment at Chattar Bagh might be successful. Mr. Ferguson hopes shortly to renew this experiment in the Rawalpindi district at about this altitude.

MEMORANDUM ON BEE-KEEPING IN BURMA, BY THE ENTOMOLOGIST TO THE GOVERNMENT OF BURMA, DATED THE 14TH NOVEMBER 1934.

Bee-keeping in a primitive form exists in the hill regions in the north of Burma not within easy reach of the Agricultural Department officers.

An experiment with the Indian Hive Bee was carried out at Maymyo in bar frame hives in 1921-22. The results, due to poor yield, swarming propensity of the bees and ravages of the wax moth, were hardly likely to create enthusiasm in a would-be bee-keeper.

Another experiment with the same bee was started lately at Sinlunkaba in Kachin Hills but had to be stopped owing to retrenchment of the post of the Agricultural Assistant.

A scheme was considered and money provided for importing from Italy and trying the Italian bee at the time the first of the above experiments was in hand. In order to guard against importation of diseases, the advice of the Secretary, British Bee-keepers Association, was taken and he recommended an apiary in Italy which he had seen. But transport difficulties stood in the way and the matter ended there.

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COPY OF LETTER No. 4199/Se, DATED THE 13TH NOVEMBER 1934, FROM C. C. GHOSH, Esq., B.A., F.R.E.S., ENTOMOLOGIST, BURMA, MANDALAY, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA, S.W.

I have the honour to say that I have had an opportunity of studying the two schemes of research on apiculture, one by Dr. George and the other by the Baroda Government, at present under consideration of the Imperial Council of Agricultural Research. As the Pusa experiments were carried out by me I take the liberty of saying a few words on the two schemes.

The results and conclusions of the apicultural work at Pusa with Italian and Indian bees and recommendations for future line of work in apiculture will be found not in Pusa Bulletin No. 46 but in a paper on Bee-keeping in India read in the Third Entomological Meeting at Pusa held in 3rd to 15th February 1919 and published in the Proceedings of that meeting pp. 77-782. An important discussion will be found there.

Dr. George speaks in general terms of European bees of which there are many kinds and all are not good. The Pusa experiments were carried out with the Italian bees. Their performance at Pusa which is in this plains was immensely superior to that of the Indian bees in that they yielded 60 to 90 lbs. honey every year compared with 6 to 16 lbs. of the Indian bees. Therefore the statement of Dr. George that "it has not been established that weight for weight the European bee is superior to the Indian and even granting that it is so in its native environment, its records so far, in the plains of India are far from satisfactory" requires modification. Besides in bee-keeping the results have to be judged by total yield and not by a comparison in yield according to size, weight or capability.

An experiment which enabled up to 90 lbs. honey being taken from a single hive of Italian bees and up to 16 lbs. from a hive of the Indian bees at Pusa was probably not as imperfect in methods as has been supposed by Dr. George.

Dr. George's proposal is to improve the Indian bee (*A. indica*) by selection and breeding so as to increase the longevity of the worker and fecundity of the queen and to lessen the propensity to swarming and to study suitable size for hives, pasturage, etc. All this is very good as scientific studies but hardly expected to further the cause of bee-keeping very much. Even if successful it is a question of many years of work.

In all countries where bee-keeping has flourished it has been due to importation and establishment of better yielding races. The results are quick. The Italian bees have been found to be suitable and to resist the wax moth. It seems advisable to give them a good chance in a suitable locality. It does not seem wise to launch experiments in a scattered manner in three different places. It is quite possible that other races may also be found suitable. It would be advisable to try them later on.

The Baroda scheme has apparently been drawn up by one who does not seem to have sufficient knowledge and experience of bee-keeping.

Beekeeping is not like ordinary experiments in crops. It requires a special knack on the part of the experimenter. In United States, America it is reported that

only about five per cent. of those whose attempt become successful beekeepers. When money is available it is necessary to see that an experiment is carried out properly. Otherwise failure on the part of the worker will cause a set back.

#### A REPORT ON BEE-KEEPING IN ASSAM.

Bee-keeping in a primitive state has been in existence in Assam for a very long time in the hands of the Hill tribes of Khasi and Jaintia. Honey is also collected from the combs of wild bees found in plenty all over Assam; a large quantity is regularly exported to Bengal and other provinces. Even in the plain districts of Assam bees of all the indigenous races are found everywhere in their natural state.

No systematic study has yet been carried out in beekeeping. The work was taken up in a small way in 1927 by the Entomological Assistant, when only 3 colonies of *Apis indica* were reared in improvised bee boxes. Later on Pusa bee boxes were introduced. 4-6 colonies are being reared every year. This work was taken up with a view to study the following :-

- (a) The possibilities of successful bee-keeping as a subsidiary occupation of the cultivators and amateurs.
- (b) The climatic and seasonal factors as well as bee pasturage in the district.
- (c) The factors that influence swarming and the means to prevent this.
- (d) The enemies of bees and methods for their control and also
- (e) To popularise bee-keeping and supply improved hive boxes to the intending bee-rearers.

It may be noted here that there is no separate staff or grant for bee-rearing. The work is being done by the Entomological Assistant in addition to his own duties and consequently the records of observations of which a summary is given below are neither systematic nor continuous.

1. In normal years colonies of *Apis indica* migrate to and settle in the plains from December to June. In our apiary at Jorhat they actively work from October to July. August and September are the worst time for them. They suffer more from lack of pasturage than the effects of climate. Unless sufficient honey is left in the colony, they need be fed artificially during these two months. Thus the strength of the colonies is maintained throughout the year.

The average yield of each colony at Jorhat varies from 10 to 12 lbs. although individual colonies yielded up to 20 lbs. Mr. B. C. Basu, the late Deputy Director of Agriculture, Assam, recorded a yield of 20 to 30 lbs. from a colony of *Apis indica* in Khasi Hills. At Shella (Khasi Hills) the Entomological Assistant recorded once 42 lbs. in a colony in the year 1927.

2. During the wet months of July, August and September bees are not quite happy in the plains. Though climate has an effect on them, lack of pasturage is the main limiting factor. The neighbourhood of the Jorhat farm is not particularly rich in honey plants. Bees gather their honey here mainly from the flowers of Sun (*Machilus odoratissima*), Shealu (*Tetranthera monopetala*), Champa (*Michilia oblonga*), Mustard, litchi, Nahor (*Mesua ferruca*), Jalphai (*Elaeocarpus serratus*), Drone (*Salvia Plebeja*), Jamrul (*Lagerstroemia* spp.), Bagari (*Zizyphus Jujuba*) and a number of other wild trees.

3. The factors that influence swarming have been studied and in most cases suitable methods have been used to prevent this whenever wanted.

4. Wax moth hornets, lizards, ants and king-crows are found here as enemies of bees. In controlling them the essentials are mainly a well-designed hive box, a strong colony and prompt action on the part of the rearer.

5. A small apiary has recently been started in the Shillong Fruit Garden. The situation is not very suitable as it is too much exposed on a high hill. The Upper Shillong farm will be a better station, if such work is to be carried on systematically. The two cattle farms in Khanapara and Sylhet are also quite suited to Bee-keeping. There is a growing demand on the part of the public to take up bee-keeping and every year some colonies are supplied to interested individuals.

6. In regard to suitability of Assam for bee-keeping it may be stated that the position of Assam as to successful bee-keeping is unique. In the Third Entomological meeting held at Pusa in the year 1919 Mr. C. C. Ghosh read a paper on the prospects of Bee-keeping in India. He preferred Shillong to other stations for carrying out researches on Bee-keeping. This deserves consideration.

COPY OF LETTER No. 2625-T. D./17/233, DATED THE 30TH JANUARY 1935, FROM THE SECRETARY TO GOVERNMENT, NORTH-WEST FRONTIER PROVINCE, TRANSFERRED DEPARTMENTS, PESHAWAR, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI.

SUBJECT :—*Research work on bee-keeping.*

I am directed by the Government of the North-West Frontier Province (Ministry of Transferred Departments) to refer to the correspondence ending with your letter No. F. 116/34-Agr., dated the 8th January 1935 and to forward herewith a note by Lieutenant-Colonel E. W. C. Noel, C.I.E., D.S.O., Director of Agriculture and Allied Departments, North-West Frontier Province, on bee-keeping in the Kurram Valley.

EXPERIMENTS ON BEE-KEEPING IN THE KURRAM VALLEY, NORTH-WEST FRONTIER PROVINCE (1925-1927).

Bee-keeping on modern lines was taken up in the Kurram in the year 1925.

The following is a brief description of the indigenous methods that are followed :—

“Bees are kept in hives known as “Ghundai”. The hive is a hollow recess in a wall of a house with an opening on the outside for bees to go out and a wooden board covering a hole in the inside to give access to the hive. A colony of bees is known as “Dombakai” and the comb is known as “Piatcha”. A swarm is known as Ziak.”

In the month of March the hive is opened from the back and the bees are driven away from the comb by smoke. All queen cells except one are removed. It is believed that there will be as many swarms as queen cells. The absence of queen cells which are known as “Tye” is said to be due to the barrenness of the original queen. There generally occur 3 swarms in the year—the first about April the 20th. The honey harvest is gathered twice in the year; firstly when the spring crops are cut, viz., about June the 15th and the second crop when the autumn crops are cut about September the first. The bees are driven away from comb by smoke and about 2/3rd of the comb is removed from which the honey is extracted. A swarm for its first year will make about 8 combs. The combs never exceed 8 inches in depth. In 2nd and subsequent years about 20 combs are obtained which is a maximum number. The honey harvest in a good year is about 40 lbs. A swarm costs about Rs. 3. Drones are known as “Liakhors” namely “Useless eaters” or “dums” namely actors and actresses. It is thought that their chief duty is to scout and discover a suitable place for the bees to make a nest.

It is firmly believed that the swarm consists of young bees and no old ones.

The Kurram bees *Apis Indica* Var. *Montana* build their comb 5 to the inch as compared to the 5½ in the case of European bees. The hill species found in the Kurram is much nearer the common *Apis Mellifera* the honey bees of Europe.

In the year 1925 two modern hives were obtained and with great troubles two swarms were hived. The local bees showed the greatest disinclination to enter the hives or stay there. One swarm developed wax moth and the other made no progress. In the end the bees deserted it.

As the result of information that a certain Mr. Clinton Bond had succeeded in keeping Indian bees at Quetta in English bar framed hives, an English bee-keeper (a private from the 2nd Battalion, Seaforth Highlanders, whose services were lent from the summer) was sent to Quetta to study Mr. Bond's methods and to obtain one of his hives.

Mr. Bond had designed a special type of hive using a standard frame reduced in depth to 5½” and smaller sections (6⅜ × 3½ × 1½).

In regard to the difficulty of getting the swarms to stay he advised that when taken they should be kept in a cool quiet shady place (allowing them to fly) and not driven into the bar-frame hive (on its permanent stand) until sunset, and then fed. He also suggested that a piece of comb with young larvae might prevent a swarm leaving the hive.

The Imperial Entomologist advised the use of a special foundation with cell bases corresponding to those of Indian bees. Mr. Bond on the other hand advised the use of English comb foundation but cut into strips of two inches in depth. This gives the bees a straight midrib as a guide. The bees draw out the cell impressions only to the end of the foundations after which they build their own size cells.

The following is an extract from a report, dated May 7th, 1926, which shows the progress made :—

“Pte. Davidson duly arrived here from Quetta and starting from April 25th has been hiving swarms.

At first his experience was that of last year namely that the swarms would not stay in the hives. We then tried getting a local hive and cutting out the comb which we tied on the frame with wire. Even then the bees deserted. We have certainly now got 4 hives in which the bees seem to be working fairly well. The local people attribute this failure firstly to using deodar timber for the hives which they say the bees object to and secondary to the fact that bees are accustomed to local hives which are much warmer from being placed in walls. I have now ordered some hives made from blue pine which the locals advise and I am also trying one or two hives which I built round with bricks. In a week or two when the weather gets warmer I am going to continue our operations in the hills at about 9500'. The local people maintain that much better results are obtained in the hills where the flowers are very plentiful. I am told that as much as 50 lbs. of honey has been obtained from one hive in a year in the hills. The bees here are migratory and I therefore anticipate that there may be some difficulty in keeping them in the hives in the hills. However I hope to overcome this by surrounding the hives with brick work as already described’.

The difficulty of inducing the swarms to remain in the hives still continued. The local bee-keeper complained of the same trouble but not to a similar extent.

Our experience showed that not more than one swarm in 6 or 7 would establish itself. In Europe the system followed is to place frames containing brood with the swarm to induce them to stay, but where bee-keeping was being established for the first time this was obviously not possible. The first solution which suggests itself was to buy whole hives from the local bee-keepers, to cut out the comb and wire it into the moveable frame. This solution first promised to be satisfactory but it was found that in many cases the bees after hatching out the brood in the comb when taken out of the old hive, deserted the new hive. Another remedy was to place queen excluder over the entrance of the hive. It was found in practice that the worker bees start to desert but the queen not being able to get out the swarm after flying round for a time return to the hive of their own accord.

Among other remedies tried were the clipping of the wings of the queen and placing the swarm bodily in the brood chamber and then shutting the bees up.

In addition to Parachinar (5,000 ft.) some 3 or 4 hives were started on the Sufed Koh at an elevation of 9,500 ft. The rainfall on the mountains is considerably higher and in August there is an abundant growth of wild flowers. One of the hives did well and in September produced about 10 lbs. of honey in sections the appearance and flavour of which were excellent.

However the experience of 1926 led to the conclusion that there was little prospect of extracting honey on a commercial scale with local bees, as owing to their long residence in small hives they had developed the swarm instinct to an extent which does not permit of their being worked on modern lines and it was therefore decided to try and introduce the Italian bees instead of continuing to work with local bees.

Two strong colonies of Italians in ten frames were brought out in August/September 1926. About 2/3rd were found dead on arrival but the queens were alive and started laying eggs. By the winter there were 5 frames of stores.

It was decided to import further Italians in 1927 and the question of the method arose. The following were the alternatives suggested by Messrs. Taylor, the well known firm specializing in bee-culture :—

“1. Nuclei containing a queen and three or four frames specially packed, which would arrive in good condition by Air Mail. We consider that the queens and two or three hundred bees would be of insufficient strength to stand the journey. Sealed brood from other colonies might be given to these Nuclei to help them to increase quickly and preserve the temperature of the hive. The Italian queens would, of course, eventually raise pure Italian colonies.

‘ 2. You might, if an Italian colony swarms, take out queens cells and insert them into other hives from which queens have been removed. The drawback about this arrangement, however, is that the queens would probably not be mated by Italian drones, and consequently the strain would be lost.

3. Another alternative is to have strong stocks in seven or eight frames sent out and by doing this you would obtain Italian colonies quicker, but if they died on the journey the loss would, of course, be greater".

In the end it was decided to bring out 3 Nuclei with 5 frames and 3 strong stocks in 8 frames. They left England on June 27 and arrived at Parachinar on July 25.

The three strong stocks arrived in fair condition but two out of the three of the Nuclei had entirely perished.

The Political Agent went home on leave in 1927 and his successor who took no interest in the matter allowed the bees to perish in the winter of 1927-28.

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*Extract from a letter No. 1315, dated the 10th Dai 1343 Fasli, from the Director of Agriculture, Hyderabad, addressed to the Secretary to Government, Department of Commerce and Industries, H. E. H. the Nizam's Government, Hyderabad.*

I have the honour to say that an experiment with Bee-keeping has been made at the Rural Development Centre, Patancheru, about 20 miles from Hyderabad, during the last 3 years. A number of hives of *Apis Indica* were imported twice from Coimbatore, Y. M. C. A. Rural Reconstruction Centre. But, the bees gradually declined in condition and deserted the farm for good, with the result that we have no hives at present. The reason seems to be lack of pasturage, chiefly in the summer, and unsuitability of the climate. A survey of the locality has shown that the species *Apis Indica* does not exist any where round about Patancheru, although the Rock Bees, Little Bees and Dammer Bees are available in great abundance. This fact also indicates that the conditions obtained at Patancheru do not suit the domesticable *Apis Indica* species.

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COPY OF LETTER No. O. 4175/G./A. I. E. 109-34, DATED THE 22ND DECEMBER 1934, FROM THE SECRETARY TO THE GOVERNMENT OF HIGHNESS THE MAHARAJA OF MYSORE, DEVELOPMENT DEPARTMENT, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI

With reference to your letter No. F. 116/34-Agri., dated the 20th October 1934, regarding work done in connection with bee-keeping in the State, I am directed to forward herewith a copy of a Note prepared by the Entomologist of the Agricultural Department on the subject as also a copy of Bulletin No. 10 of the Entomological Series of the Mysore Agricultural Department. I may add that the following items of research work on Bee-keeping of All-India importance could be undertaken by the State Entomologist with some additions to the existing facilities—available at the Bangalore and Babbur Farms (Hiriyur).

- (1) Raising of Queen Bees for hybridization and distribution.
- (2) Hybridization between select Indian and foreign bees.
- (3) Study of flowers the bees visit and introduction of suitable foreign flower plants as a bee pasture.

The Mysore Government will be glad to have a detailed scheme prepared and submitted to the Council, if the Council could provide the additional funds that may be required.

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**BEE-KEEPING WORK IN THE ENTOMOLOGICAL SECTION OF THE DEPARTMENT OF AGRICULTURE, MYSORE STATE.**

A primitive method of Bee-keeping has been in existence in the villages in the hill forest areas of the State from a very long time. The raiyats in these villages keep a few pots of bees more as a curiosity than as a regular source of honey supply. It is seven years since the Agricultural Department started Bee-keeping on improved lines and the first work attempted was to educate and induce the raiyats in the hill forest areas to replace their pot hives with box hives of improved pattern. A small apiary on improved lines was started in that area and demonstrations of improved bee-keeping methods were made in several centres and hives of improved pattern were left with the villagers.

Demonstrations of improved bee-keeping methods were made in all the important cattle fairs and exhibitions in the State and short courses in practical bee-keeping were held in the Departmental apiary in Bangalore for the benefit of prospective bee-keepers and thus a very great interest was created in improved methods of bee-keeping among the Landlords and cultivators in the plains. As a result of this bee-keepers and thus a very great interest was created in improved methods of bee-intensive work of popularising improved methods of bee-keeping there are about 80 colonies of bees in improved box hives working in different parts of the State. In addition to the above there are about 50 colonies in improved bee-hive boxes kept in private residences in the City and extensions of Bangalore.

Most of the Agricultural Schools in the State are also provided with a colony of bees in improved box hive for instruction purposes. It has been found that the intensive propaganda and demonstrations did not induce the raiyat classes to take to bee-keeping. As a preliminary to establish bee-keeping as a subsidiary occupation for the raiyats a few village panchayats and cultivators in a few villages in Bangalore are induced to keep a few colonies of bees in improved bee hives, the hives and appliances being supplied free for a reason in addition to the free and constant departmental supervision and advice.

Along side with the popularising of improved bee-keeping methods particular attention has been paid to the bionomics with reference to the life history, swarming and other habits, honey gathering capacity, etc., of the Indian bee, *Apis Indica*. A maximum of 25 lbs. of honey per hive has been extracted in 4 or 5 extractions from a strong colony of bees during one year. After repeated experiments with several types of box hives, a standard type of hive suited to *Apis Indica* has been made and is being popularised.

A small attempt has been made to find out the important flowers the bees visit for gathering nectar and pollen in different seasons but much progress has not been made.

A small apiary was established in one of the Government farms at Babbur, Hiriya. Coconuts, plantains and cotton are the chief crops in the area and the bees are found to thrive very well there.

For extraction of honey, the centrifugal extractors supplied by foreign firms were found to be rather very big. A small type of honey extractor to suit combs of *Apis Indica* has been made locally and is priced at Rs. 10 each.

A Bulletin on "Bee-keeping as a subsidiary occupation for the raiyats" has been published by the Department.

*Queen Rearing.*—Queen rearing is a very important item in apiculture and no successful bee-keeping could be undertaken and established on a sound basis without this. Owing to the importance of this the Government deputed the Entomologist and the apicultural Fieldman to Ceylon to study the Queen rearing methods adopted by the Secretary, Bee-keepers Association, Ceylon.

It was programmed to start raising queens from some of the colonies known for their gathering capacity, prolificity mildness, etc., in the Departmental apiary and to start hybridising work with the best Carniolan bees arranged to be imported from Austria, but owing to lack of funds for importing Carniolan bees and adequate staff, it has not been possible to undertake this very important work. Carniolan bees are noted for their prolificity and mildness and are largely imported into Egypt and very successfully reared in the hot climate there and I am of opinion that cross breeding of these with the Indian bee (*Apis Indica*) will produce an ideal bee suitable for Indian conditions.

In conclusion I have to state that there is a very great scope for the establishment of Bee-keeping as a subsidiary occupation for the cultivators in India and before this object is achieved, a number of nucleus apiaries will have to be established in different parts of the country and much research work has to be done in these apiaries particularly as regards the study of bee pasturage and evolution of a suitable type of bee by cross breeding the Indian bees with suitable foreign types of bees.

MEMORANDUM OF THE BEE EXPERT SHOWING THE EXPERIMENTS MADE, RESULTS OBTAINED AND THE WORK IN PROGRESS ON APICULTURE IN THE COCHIN STATE.

The importance of Bee-keeping as a valuable cottage industry conducive to rural reconstruction suggested itself to the Economic Development Committee working under the Government in 1103/1927. The Committee then was being presided over by the



Director of Public Instruction. He selected me, then a teacher, to undergo a course of instructions on the subject and deputed me to the Y. M. C. A. Rural Reconstruction Centre at Marthandam in Travancore where something was being done for the promotion of the Industry. I came after a course of training for one month and endeavoured to start the industry on the lines pursued at Marthandam without prejudice to my teaching work. As I was unable to secure much knowledge on the practical side of the industry as a result of my training in Marthandam my efforts did not prove much of a success. I was accordingly deputed to the Y. M. C. A. Rural Reconstruction centre at Ramanathapuram in Coimbatore District in 1104/1923 where also some work on the subject was being done. I underwent two months' training there. On my reversion I continued my work as a teacher but devoted all my spare time experimenting on the various phases of the industry. My efforts this time attended with success. I got a thorough knowledge over the subject. The results of my investigations and experiments touching the various phases of the industry, I took care to record then and there which when finished contained materials enough for publication of a small book in Malayalam which I have brought out. In order to enhance the utility of the book from a practical point of view, the book was also well illustrated. Till 1106/1930, I continued to discharge my dual function as best as I could. The success which attended my work convinced the Economic Development Committee at this stage that the success of the industry in a wider range comprising the whole of the State demanded my appointment as a full-timed officer. My services were accordingly taken over exclusively by the Economic Development Committee and thereafter I was enabled to set to work in right earnest. The first concrete step in this direction was the manufacture of wooden hives and their location in suitable places all over the State.

The knowledge of the people about honey is as a forest produce. Until my appointment they had not come to realise the economic value of Bee-keeping and the possibility and success of its introduction as a useful and valuable cottage industry. The honey marketed is usually of a crude variety collected by the aboriginal tribes inhabiting the jungles and forests. The process by which they collect honey leaves much to be desired and is very unbusinesslike from an economic point of view. When they have spotted the places where bees have formed their colonies they attack them with lighted torches. This process either destroys the bees or scare's them away. These ignorant people then rob the bees of their combs, squeeze out the honey contained in them and hand it over to the middlemen in an impure state. The honey thus obtained will on the first instance contain dead flies, their eggs, particles of wax and a lot of other impurities. At time the honey is purified before marketing so as to fetch more prices. This process deprives the industry much of its economic value. Destruction of bees is destruction of the industry. The bees that escape do not keep idle but after long wanderings again pitch upon a favourable place and begin their work all over again. But the destruction of their original homes compel them to make one afresh before collecting honey and this process takes a pretty long time. The success of the industry, it is obvious, depends upon the collection of honey without killing nay even injuring the bees and keeping the combs intact. It is with this end in view, that artificial wooden hives have been introduced.

*Wooden hives.*—The principles underlying the construction of these hives are copied from the formation of natural combs although the general shape is not exactly the same. The wooden hives are about 10" x 8" in size (Brood box) and are provided with a suitable roof to afford protection. The expert when he has discovered a colony of bees slowly approaches it, removes the combs one by one and transfer them into the hive (and this takes place generally during day time) without causing any injury to any of the bees, injury caused to a single one will be adequately rewarded. Besides, this will lead to the desertion of the hives by the bees. When it is dark the hive will be removed to the permanent place.

Next comes the stage of extraction of honey where again there is the risk of injuring the bees and consequent desertion besides being exposed to the disadvantages mentioned above. An artificial extraction of a very simple model with a suitable reservoir is used for the purpose. By this process all the honey collected in a hive to the last drop can be extracted without causing the least injury to even a single bee and the combs and the honey thus obtained will be quite neat and pure and free from impurities. This system, while the greedy man robs the poor bees of their treasure and food gathered up after a strenuous labour and a busy time, never causes damage to their home or life. Undaunted and undisappointed by the loss of their dependence, they go on working again and refill the combs with honey again. The watchful and greedy man repeats the process. The economic value of the industry can be more or less estimated from this fact that a well-built colony, favourable conditions existing, will yield 2 to 3 lbs. of honey once every fifteen days, during the honey

season in which plants and trees profusely flower. The conditions conducive to the thriving of the industry are :—

- (i) That the hives should be frequently examined and kept free from insect pests. These are scorpions, reptiles, ants, wax-moth, etc., which like man are ever on the lookout to rob bees, their combs and their delicious treasure.
- (ii) The hives should be placed if not in the midst of garden luxuriant with flowering plants and trees, at least at a place not far from such places. It may be noted in this connection that bees travel over a distance of one mile in quest of flowers.
- (iii) Shelter from the inclemencies of weather.
- (iv) Feeding of the bees during the winter and other seasons when flowers are dear. The food they are expected to be given is either sugar syrup or pure honey itself. This has to be done once a week. Feeding is also advisable as soon as the swarm is hived.

Now the work I have been doing during the last 3 years for the popularisation of the industry all over the State can be classified under the following heads :—

- (i) Propaganda for the popularisation of the industry.
- (ii) Examination of hives kept in the various parts of the State.
- (iii) Lectures and demonstration lessons at meetings, exhibitions, and other important meetings.
- (iv) Regular courses of lessons on the subject to the pupil teacher undergoing training in the Training Institution and Central Farm.
- (v) Having new colonies and setting them up in new places.

Although the contempt and prejudices of the public towards the industry have been conquered to a great extent due to my incessant work among them, practical steps on their part to take kindly to this industry even as a subsidiary occupation having been found sadly lacking, my attention had been mainly concentrated during the years on vigorous propaganda among the masses. In doing so, I made particular care to select centres and villages possessing exceptionally favourable conditions for the industry to thrive rapidly. House to house visits, instructive discourses, public lectures and demonstration lessons with the help of suitable charts prepared, training of suitable hands, distribution of leaflets on my work on the industry helping interested individuals to hive bees, all these took up a substantial and much portion of my time and work. The public have begun slowly but surely to realise the scope of the industry and to feel that they stand to gain much without having to spend anything. It is this realisation that is the way to success of this industry and it has been towards this end that I had been striving so far. It is in a fair measure of realisation and augurs well for the future of the industry.

## II.

Examination of hives kept in both Sirkar institutions and private houses scattered all over the State formed another important part of my work. Altogether there are 132 hives of which 47 were hives supplied by Government and 85 set up by private individuals at my instance. The safety from insect pests forms the most important factor in the success of the industry. In the case of hives kept especially in private houses, the ignorance on the part of the custodians of the hives and inadequate attention led to many of the hives being deserted due to insect pests. In the course of my propaganda tour I used to examine as many hives as possible both Sirkar and private which helped to a great extent in minimising the disappointment on this account. Several owners have expressed to me in great appreciation that they had begun to get something in return for the pains taken and that domestic purposes were being fully served by the honey their hives were yielding.

## III.

Lectures and demonstration lessons occupied two important planks on my programme of work. I took part in almost all important School Day celebrations, Teachers' Conferences, Exhibitions and other functions. These have as a rule come

to be regarded as essential and integral part of all important public functions conducted under the auspices of the Education Department. A substantial portion of my work during the years consisted of these and I must say with a certain amount of pardonable pride that these have been productive of certain good results on the whole. In the year 1105 I attended the Chittur Exhibition and in 1106 I demonstrated hives at the Agricultural and Industrial Exhibition at Wadakkancheri. The exhibition authorities at Chittur and Wadakkancheri awarded me certificates of merit. In recognition of the valuable services rendered by me the Exhibition authorities at Irinjalkuda awarded me a gold-centred silver medal and those at Trichur a gold medal. A separate stall was secured for the demonstration of the bee-industry at all these Exhibitions. The system I adopted at these functions was to collect a group of hives engaged at different stages of their work. Throughout the time the exhibitions were open to public I remained in the stall and freely and in detail demonstrated to the public all the phases of the industry including the extraction of the honey without injuring the bees. The lectures I have given in various parts of the State were accompanied by practical demonstration lessons wherever possible.

One important matter which deserves to be mentioned is my participation in the School Fair and Exhibition at Calicut. The organisers of the Exhibition having requisitioned my services I was deputed with special Government sanction, the exhibition authorities having met all my connected expenses. My work was much appreciated by the organisers and I was awarded a certificate of merit as a token thereof. Of all things, the participation in this function helped to give a wide publicity to the earnest efforts the State was making in introducing a new hopeful cottage industry conducive to rural reconstruction work and efficiency with which it was being carried on. Ever since the event there was a greater demand from far and near for my book on the Industry, which goes to show that the possibilities of the industry have caught the imagination of the people throughout the State.

I came into contact with Honourable Sir M. Krishnan Nair, ex-Law member, who happened to be the president of one of the functions. He spoke to me in every appreciative and encouraging terms about my work and the possibilities of the industry. I also came into touch with Mahatma Gandhi during his visit to the State, when I demonstrated to him the various phases of the industry including the extraction of honey without causing injury to the bees and the honey thus extracted was also handed over to him at the spot.

With a view to have on the staff of each and every school in the State one teacher trained in the industry, I engaged the teachers who were undergoing training in the Central Farm at Ollukara and those in Government Training institution, on the various stages of the working of the industry accompanied by suitable demonstrations.

With a view to obtain the co-operation of the Panchayat Department with regard to the popularisation of the industry in the rural areas where the industry had better prospects of success, I met the Panchayat Registrar and discussed with him about the measures to be adopted by the department on the lines on which the work was to be carried out. He is trying to have it introduced in the various Panchayat officers under him.

As I thought the co-operation of the Co-operative Department would do something in the matter and with a view to have this aspect also brought to the notice of Mr. G. K. Devadhar, M.A., C.I.E., of the Servants of India Society, who was investigating the working of the Co-operative movement in the State, I approached him and had a detailed talk on the subject in relation to the co-operative movement. He also promised all possible help.

In the course of my tour, I have come to know that the depressed class colonies in the State afford facilities for the introduction of the Bee-industry in them. These colonies are in most cases villages bordering hilly tracts and places blessed with profuse vegetable growth and flowering plants of all descriptions which are just the conditions suitable for the development of the Bee-industry. The depressed classes such as Pulayas, Malayas, etc., are as a class acquainted with the industry in an indigenous manner and the spread of the modern ways of putting it on a more profitable basis will surely interest them.

Accordingly with the permission of the Protector of the Depressed Classes, I am just embarking on the introduction of the industry in the Depressed Class colonies.

To satisfy the incessant demands from public bodies, institutions and individuals, it has become necessary to open a central store with sufficient number of hives. With a view to achieve this object the construction of a suitable shed in a school bordering

the forest tract is just complete. This is meant to secure as a laboratory for demonstration purposes and a central reserve store for the supply of hives according to demand.

It may be stated in this connection that the State has been deriving no income from the industry so far; and that all the work carried out hitherto was only in the shape of experimentation, demonstration and popularisation of the industry.

MEMORANDUM OF BEE-KEEPING INDUSTRY IN TRAVANCORE, BY C. R. THOMPSON,  
APICULTURAL ASSISTANT.

Although some attempts were made to investigate the possibilities of introducing Bee-keeping as a Cottage Industry in India some 50 years ago, nothing tangible had been done for a long time. About 20 years back Rev. Fr. Newton of Trichinopoly showed that *Apis Indica* could be domesticated, reared in a suitable hive and made to produce a good storage of honey. Prior to this most people had serious misgivings as to the possibility of controlling and domesticating the Indian Bee and sought to introduce Apiculture by the importation of European Bees and acclimatising them to Indian conditions.

There were several reasons for believing that the *Apis Indica* may not be amenable to rearing under artificial conditions. The people were not aware of the benefits of bee-keeping. The stings of bees were so painful and their natural haunts were so inaccessible that it was not easy to get at them. The only way of foraging their honey, was by first destroying the bees by setting fire to their abode and then recovering whatever may be left in the partially burnt combs. The efforts of Fr. Newton however, were crowned with success. I underwent training under him, as a student deputed by the Government of Travancore. On my return in 1917, work was started to introduce bee-keeping.

As a result of the propaganda, carried on during the past few years several ryots have taken to the Industry and there are at present more than one thousand Apiarists in Travancore. It may also be pointed out that Travancore has been the Pioneer of this Industry in India.

The Apicultural Assistant used to render help even to persons outside the State. So long ago as in 1919, Bee Hives and other appliances were supplied to Mr. Mazhar Hussain, Director of Agriculture, Hyderabad State. Bees and bee-keeping appliances were also supplied to Nawab Ali Yaver Jung Bahadur of Vickerabad, Hyderabad and Capt. Saint John Ives in Coonoor, with trained men to look after their apiaries. Several applications for the supply of colonies of bees with hive, honey extractors, etc., were received from Mysore, Bangalore, Madras, Kurubalakota, Tanjore, Kumbakonam, Coimbatore, Tiruppur, Bengal, Berar and Tinnevely and the requisitions were in all cases readily complied with.

The Y. M. C. A. Rural Reconstruction Centre at Marthandam which has of late been in the public eye, started its Bee-keeping activities, at my instance and under my guidance and supervision, in the year 1925. It will thus be seen that the progress which this Industry has made in the different parts of India is due partially if not mainly to the help rendered by the Apicultural Assistant of the Department.

*Experiments and Results.*

*Hive.*—The first hive was got down from Trichinopoly at a cost of Rs. 12. It consisted of one brood chamber  $9\frac{1}{2}'' \times 7\frac{1}{4}'' \times 6''$  and two supers  $9\frac{1}{2}'' \times 7\frac{1}{2}'' \times 3''$ , bottom board, top cover and roof. It had six frames in each of the chambers.

A dozen hives of this pattern were made in teak wood locally and they were set up with local wild swarms. Six of these were placed in a Farm at Nedumangad, a typical forest area in Travancore and the remaining six in the office premises of the Director of Industries, Trivandrum. These hives were kept under close observation and their suitability for local conditions studied. The following points were then noted—

1. The hives had to be protected from ants.
2. The roof was inadequate to afford protection against inclement weather prevalent in Travancore during certain parts of the year.
3. Water got into the interspace between the supers and the body hive.

4. The body hive rested in a groove on the bottom board in such a way that rain water collected inside.
5. The ventilation in the hive was found to be very unsatisfactory.

Even with a good deal of precautions it was found impossible to allow the colonies to thrive or to obtain a fair quantity of honey. A very careful study of the habits of the bees and the changes brought on them by variations in weather conditions enabled me to effect certain improvements in the imported types of bee-hives. They are the following :—

1. Cheap portable individual stands were provided with a receptacle at the base for water which will prevent the coming in of ants.
2. The roof was made sufficiently wide to afford protection from heavy rains.
3. The interspace between the body hive and supers was protected by sloping battens so as to allow the rain water to escape.
4. The body hive was made to rest on four supports on the base board with battens inside. This arrangement prevented any water from collecting on the bottom board.
5. A reversible cover with ventilation was provided below the roof.

With these improvements hives were made locally in teak wood and sold to the public at Rs. 4 each and several such hives are now in use in various places in and outside the State. The local Y. M. C. A. when they started their Rural Reconstruction work at Marthandam in 1925, under Dr. Spencer Hatch, was supplied with large number of these hives for demonstration and popularisation.

Further experiments with these hives revealed the following defects :—

1. The space in the brood chamber was insufficient for young prolific queens for breeding purposes. Consequently they very often found their way to the super and laid eggs there thus making extraction of honey impossible.
2. In forest areas this type of hives were found to be too small to contain even half the swarm with combs. Such hives are however, suited to areas where there is scarcity of flowers. Hence arose the need for a hive with arrangements to increase or decrease space.
3. Bees were found to build combs between the frames. On measurement of the spacing breadth of the frames it was found to be  $1\frac{1}{4}$ " and the interspace between combs  $1\frac{1}{2}$ " but the space necessary was only  $\frac{1}{2}$ ". Therefore the breadth of the frame was reduced to  $1\frac{1}{4}$ ".
4. The bees were found to build combs only on the top bar of the frame. The other three sides being unfastened the chances of their breaking in were great. In the new hives bees are forced to build combs from the top bar and fix in the lower by reversing. If the comb starters are small, they are placed in such a way as to force the bees to extend them to the sides.
5. Since the combs in the old type of hives did not fill the entire frame the yield of honey obtained was comparatively small.
6. The bees were not found to work in the second super as vigorously as in the first. The introduction of the bigger extracting frames facilitated easy movement and overcome this difficulty.
7. A colony would not work to the fullest extent unless it is allowed space in proportion to its strength. The provision of a division board in each chamber enabled the apiarist to increase or decrease the space according to requirements. This is a special advantage in the type of hives newly designed.
8. The old pattern hive was small and did not provide sufficient space and this led to swarming due to congestion. The new hive with arrangements to increase or decrease space obviated this difficulty.
9. The bees ordinarily build their queen cells on the lower edges of the comb when they are hanging loose. In the old type of hives the combs would hang loose from the top bar of the frames and hence the bees were able to build their queen cells with great ease and send out swarms. The present type of hives with reversible frame help the apiarist to check the tendency to build queen cells. The queen cell has its mouth downwards. When the frame is reversed the position of the larva in the cell will be altered. In this position the bees will not allow the cells to develop.

The detection of the defects and the discovery of suitable remedies are the results of the experimental work conducted for several years. Very often we see the colonies dwindling or swarming, sometimes in a large colony very little honey is collected. The causes of all these were investigated and suitable remedies suggested.

The knowledge thus gained enabled me to devise measures to remove these defects and a new hive  $12\frac{1}{2} \times 8\frac{1}{2} \times 6$ " with seven reversible frames with one brood chamber and two supers and division boards has been introduced in 1931. Over 200 hives of this pattern are now in use in different parts of the State and they are found to give satisfaction. Such hives are now being sold by the Apicultural Section of the Department of Agriculture at a price of Rs. 3 per hive without bees and Rs. 5-8 with bees.

*Wax Moth.*—One of the greatest difficulties encountered by the Bee-keeper is the control of wax moth. Once these get inside a hive and infect it, the inexperienced apiarist will find his erstwhile thriving colony being rapidly destroyed. One may get instructions from an expert or from others as to how best to keep this pest under control. Such instructions in most cases are of little value. The methods to be adopted in controlling the pest depend upon the temperature and humidity of the atmosphere in each locality. Hence all these factors should be taken into account in devising any really successful methods of keeping the pest under check. This can be done only at the spot. Ordinarily I take three to four days to make necessary observations and suggest a suitable method. The apiarists are taught how to avoid this pest and in certain localities I have achieved cent per cent. success.

*Honey Extraction.*—Efficient extraction of honey is of the utmost importance in bee-keeping. An ordinary extractor costs \$90 in the United States of America. One of the same pattern made in India may cost Rs. 40. Such appliances are too costly for an ordinary ryot in India. A cheap type of extractor, simple in construction has been devised and several such extractors have been made locally and supplied to the ryots at Rs. 4 each. Several extractors of this pattern were supplied to the Y. M. C. A. Rural Centre at Marthandam. Two other types of honey extractors have also been devised recently and they are becoming popular in the State. They cost only Rs.  $1\frac{1}{2}$  and annas eight each respectively.

*Selection of Bees.*—Of the three different species of bees found in India, viz., *Dosata*, *Florca* and *Indica*, *Apis Indica* has been found to be the best suited for rearing purposes. Bees belonging to the *Apis Indica* species are either light coloured or dark. The dark variety is ill-tempered and stings viciously even with the slightest provocation. Its honey producing capacity is limited. Three swarms of dark and three of light varieties respectively were colonised and located at one and the same place in Trivandrum and Nedumangad and the following results were obtained :—

1. The light kind of bees gave about 50 per cent. more honey than the dark. The latter was found to be lazy and vicious and careful observation and the rearing of this kind was therefore given up.
2. The light variety is gentler and better honey producer. The bees of this class are very industrious and produce a satisfactory yield (Maximum yield obtained in town area with these bees was 20 pounds). They are in great demand amongst the apiarists in Travancore.

A cross breed of dark and light variety was tried next. The hybrid was found to be inferior to the light variety in point of yield.

In an experiment conducted with half a dozen colonies of the light variety, two were found to be better breeders than producers. The remaining four were better in the matter of production. These latter are now selected for rearing purposes. There is a colony of bees under observation for the past sixteen years. They do not leave it even when they are attacked by enemies. About seven years ago there was a wax moth attack in this hive, yet the bees did not leave their hive. This colony is now being used for rearing queens so that they may not have any tendency to swarm.

*Apis Mellifica. (Italian Bee).*—Dr. Spencer Hatch of the Y. M. C. A. at my instance brought six colonies of bees from Italy. They arrived here during the hottest part of the year. I attended on them with great care and they got on well and produced honey for some time. They were however removed from Trivandrum

to Marthandam subsequently where they all died. I consider that these bees will thrive in Travancore provided they are carefully bred. By crossing this variety with *Apis Indica* and *Apis Dorsata*, it may be possible to get hybrids of great economic value.

*Apis Dorsata* or (*Giant Bee* or *Rock Bee*).—The Rock Bees are the biggest bees of India, probably in the world. Their honey producing capacity is very much greater than that of the Italian. They build a single comb and live in open air. A series of experiments were conducted with them, and their results recorded for future study.

## APPENDIX XX-A.

PROCEEDINGS OF THE MEETING OF THE BEE KEEPING INDUSTRY COMMITTEE APPOINTED BY THE ADVISORY BOARD OF THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH HELD ON THE 18TH FEBRUARY 1935.

The following were present :—

1. Diwan Bahadur Sir T. Vijayaraghavacharya, *Chairman*.
2. Col. A. Olver,
3. Mr. F. Ware.
4. Dr. S. S. Nehru.
5. Dr. V. N. Likhite.
6. Mr. S. V. Ramamurti.
7. Mr. Nizamuddin Hyder.
8. Mr. J. N. Chakravarti.
9. Mr. E. J. Bruen.
10. Mr. B. S. Patel.
11. Mr. P. J. Kerr, (Visitor).
12. Dr. Awasare, (Visitor).

Rai Bahadur Malik Charan Das—*Secretary*.

1. *Application from the Government of Bombay for a grant of Rs. 29,070 spread over three years for a scheme of research in apiculture by Mr. C. J. George, Professor of Botany, Wilson College, Bombay, (Subject No. 13 on the agenda of the Board). (Appendix XX).*

2. *Application from the Government of Baroda for a grant of Rs. 16,900 spread over five years for a scheme of research on bee-keeping for Gujerat. (Subject No. 14 on the agenda of the Board). (Appendix XX).*

After discussion it was decided that to deal with the matter satisfactorily it was necessary to constitute an expert committee. This committee, after obtaining further information as to the work which has already been done and now in progress in India, should draw up a comprehensive scheme of the investigations which would be required to develop a bee-keeping industry in India as a cottage industry, which would be submitted for the consideration of the Advisory Board at its next meeting. It was considered that bee-keeping was likely to become of increased importance owing to the village uplift movement. The Committee would at the same time deal with the two schemes now submitted. The constitution of the committee was left to the Vice-Chairman.

A. OLVER, *Col.*

DELHI;

The 20th February 1935.



## APPENDIX XXI.

NOTE DATED THE 22ND JANUARY 1935 BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT No. 22 :—APPLICATION FROM THE GOVERNMENT OF BOMBAY FOR A GRANT OF RS. 78,650 SPREAD OVER A PERIOD OF FIVE YEARS FOR A SCHEME FOR THE IMPROVEMENT OF PAPAYA BY BREEDING AND CULTURAL PRACTICES.

Attention is invited to the attached letter from the Government of Bombay, No. 3274-A/33, dated the 18th December, 1934 (Annexure) forwarding, *inter alia*, a scheme for the improvement of papaya by breeding and cultural practices by the Horticulturist to Government and the Economic Botanist, Bombay. The scheme involves a non-recurring and recurring expenditure of Rs. 8,500 and Rs. 70,150 respectively or a total expenditure of Rs. 78,650 spread over a period of five years.

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

## ANNEXURE.

*Copy of letter No. 3274-A/33, dated the 18th December, 1934, from the Secretary to the Government of Bombay, Revenue Department, to the Secretary, Imperial Council of Agricultural Research.*

I am directed by the Government of Bombay (Transferred Departments) to forward the following three schemes for grants-in-aid from the funds of the Imperial Council of Agricultural Research :—

- (1) \* \* \* \* \*
- (2) A scheme for the improvement of papaya by breeding and cultural practices by the Horticulturist to Government and the Economic Botanist.
- (3) \* \* \* \* \*

I am to state that the schemes were approved by the Provincial Agricultural Research Committee at a meeting held on 19th November 1934.

2. The Government of Bombay recommend the schemes for the favourable consideration of the Imperial Council of Agricultural Research, I am to add that they will not be prepared to undertake any financial liability on account of the cost of any of them.

*A scheme for the improvement of Papaya by breeding and cultural practices by Dr. G. S. Cheema, DSc., Horticulturist to the Government of Bombay, and Professor L. S. S. Kumar, MSc. (Lond.), A.R.C.S., D.I.C., Acting Economic Botanist to the Government of Bombay.*

The Papaya is grown throughout India, although not as yet on a large scale. Where grown, in the Bombay Presidency, it is an important and profitable crop giving a margin of profit of about Rs. 400 per acre being second in point of profit only to the Banana crop. The crop is produced in a short time from planting and can be made available throughout the year. It is, therefore, a plant which has important possibilities. In addition to its use as a fruit, it is also a source of papain for which it has not yet been exploited in India though there is a steady production of this important material from Ceylon.

The improvement of papaya cultivation depends in the first instance on the production of good races of papaya which will retain their character and which will have a large proportion of bearing trees. The breeding problem in the papaya is enormously complicated by the fact that the tree is dioecious (i.e. there are male and female trees) and in addition there are all kinds of hermaphrodite types. These have

been studied to a very small extent in India and elsewhere. Our knowledge of the inheritance of sex in the papaya is practically negligible. This is rather astonishing considering the amount of work that has been done on certain other dioecious plants and is probably due to the fact that the papaya is not easily grown to maturity in American or European hot houses. At present it is impossible to recognize the male from the female tree until flowering actually occurs and very often up to 70 per cent. of plants turn out to be males or hermaphrodite. The hermaphrodite plants often produce fruits of curious and contorted shapes which may be unsaleable. The first problem, therefore, is the study of the problem of the occurrence and inheritance of sex in the papaya and this must be associated with a study of the cytology of the sex forms. This is in itself a large piece of work, but we have thought it advisable to put it as a part of research which should include both the genetical and cultivation sides of papaya production, since while the study of genetics is going on, other problems of cultivation could be undertaken on existing papaya plantation or on plantations specially planted for this purpose. Moreover, the genetics work is definitely practical with the aims mentioned above, viz., (1) the increase of the number of female trees and (2) the fixation of useful races. It should be possible also to study at the same time the inheritance of characters such as fruit size, shape, colour and flavour.

#### *Horticultural problems.*

Besides the problem of improvement of papaya by breeding we have before us the horticultural aspect of the crop which involves the following investigations:—

- (1) Manuring of papaya trees.
- (2) The collar rot of papaya trees and Anthracnose.
- (3) The keeping quality and storage of the fruit.
- (4) Extraction of papain from the fruit.

#### *Manuring of Papaya trees.*

As stated above, the papaya if properly cultivated is a very paying crop. It is also a heavy feeder, as can be gauged from the quantity of fruits borne on the tree. Once the fruit begins to mature, the harvest is continuous over a period of at least two years. Little work has yet been done on the question of systematic manuring of this crop in India. It is, therefore, suggested that its exact requirements may be studied and the suitability of various manures—organic or chemical—may be found out by experiments especially with regard to those of their different combinations as being worked out in Citrus and Banana cultivation (4). Another aspect would be to study the effect of manuring in prolonging the period of continued good bearing which at present is not longer than two years.

#### *The collar rot of papaya trees.*

This problem is both of physiological and pathological importance. It seems necessary that the conditions under which the trees go bad and flower and fruits shed must be scientifically studied. The cause of the development of the foot and collar rot must be investigated in detail and its remedies found. The necessitates the use of big artificial containers where the effect of irrigation, soil temperature and other factors concerned can be studied. If once the causes are known probably treatment may be possible. The investigations on foot and collar rot are being followed in, Trinidad (23). But no report of work done on this problem in this country, is to hand and it is necessary to do this work under Indian soil and climatic conditions. The susceptibilities of various varieties to this disease will also be worked out.

#### *Keeping quality and storage of the fruit.*

This is both a chemical and pathological problem and very important from the commercial point of view. The fruit is easily perishable and cannot stand transport over long distances. The cultivation of the crop is, therefore, restricted to the

neighbourhood of cities where the fruits find a ready market. On account of its medicinal and digestive properties (13), the fruit is also in great demand all over the country. If the keeping quality of the fruit is improved through breeding, and proper facilities for storage are offered, it is easy to foresee that the cultivation of the crop will be extended. Storage (15) life of the fruit can be easily studied in cold storage chambers without involving much additional expenditure as we have now got facilities of a large cold storage plant at the Ganeshkhind Fruit Experimental Station, Kirkee.

#### *Extraction of papain.*

The manufacture of papain deals with an important commercial aspect of this crop. Papain is prepared in several tropical countries and there is a possibility of its being manufactured in Western India also. The great problem at present is how to get papain of a better quality for which good price can be had in the market. It is necessary that the methods of its decolorisation and dehydration should be properly worked out and once for all decided if it pays. A large number of enquiries are received on this subject.

Ceylon (13) at present holds the monopoly of export of papain to foreign countries in large quantities. If better methods of extraction and preservation are evolved and a means of keeping the colour of papain white, India can compete with Ceylon in the export of papain to Europe and America.

#### *Expenditure.*

The proposed investigation on papaya is spread over a period of five years and all the items included in the estimate have been carefully scrutinised and the expenditure reduced to the minimum commensurate with the importance of the work.

The three investigators, one each for breeding, horticultural and chemical sides of the investigation will work under the direction of the Horticulturist and Economic Botanist to the Government of Bombay, thereby doing away with the necessity of a Chief Investigator for co-ordinating the work of all the three investigators.

The laboratory will be located in the Ganeshkhind Fruit Experiment Station's premises and the ten acres of land required will be rented from adjoining areas.

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Statement of Expenditure for the Scheme on the Improvement of Papaya trees for five years to be conducted jointly by the Horticulturist to Government, Bombay Presidency, Poona, and Acting Economic Botanist to Government, Bombay Presidency, Poona.

No.	Item.	1st year.	2nd year.	3rd year.	4th year.	5th year.	Total.
		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
	<i>Non-recurring expenditure.</i>						
1	Construction of a temporary structure having a good floor and plynth 20' x 30' in Fruit Experimental Station, Ganeshkhind, Kirkee, for accommodation of the Chemical and Botanical Laboratory . . . . .	2,500	..	..	..	..	2,500
2	Laboratory equipment—Microscope, incubators, paraffin embedding oven, thermostat, glassware and apparatus for chemical analysis; stains, glassware, etc., for Cytological investigation; Laboratory tables, taps, skins, implemēts, 400 metal containers, etc. . . . .	6,000	..	..	..	..	6,000
	<i>Recurring expenditure.</i>						
3	<i>Staff—</i>						
	(i) Investigator (Botanical, of gazetted rank in class II of the Bombay Agricultural Service on Rs. 170—10—250—E. B.—15—400—E. B.—20—500) . . . . .	2,040	2,160	2,280	2,400	2,520	11,400
	(ii) Investigator (Horticultural and Pathological) of the 1st grade of Agricultural Overseers (Rs. 160—10—260) . . . . .	1,920	2,040	2,160	2,280	2,400	10,800
	(iii) Investigator (Chemical) of the 1st grade of Agricultural Overseers (Rs. 160—10—260) . . . . .	1,920	2,040	2,160	2,280	2,400	10,800
	(iv) Malis, two, on Rs. 20—1—40 . . . . .	480	504	528	552	576	2,640

No.	Item.	1st year.	2nd year.	3rd year.	4th year.	5th year.	Total.
	<i>Recurring expenditure—contd.</i>	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
	<i>Staff—contd.</i>						
	(v) Clerks, one, on Rs. 60—5/2—75 . . . . .	720	720	780	780	840	3,840
	(vi) Laboratory boys, two, on Rs. 20—1—25 . . . . .	480	504	528	552	576	2,640
	(vii) Peon, one, on Rs. 18 per month . . . . .	216	216	216	216	216	1,080
4	<i>Cultivation—</i>						
	(a) Cost of cultivation at Rs. 320 per acre per annum for 10 acres . . . . .	3,290	3,290	3,290	3,290	3,290	16,450
	(b) Lease of land at Rs. 25 per acre per annum for 10 acres .	250	250	250	250	250	1,250
5	Apparatus and Chemicals . . . . .	350	350	350	350	350	1,750
6	Implements . . . . .	100	100	100	100	100	500
7	Stationery and Miscellaneous . . . . .	500	500	500	500	500	2,500
8	<i>Allowances and Honoraria—</i>						
	(a) Travelling allowance for Investigator (Botanical) . . . . .	200	200	200	200	200	1,000
	(b) Travelling allowance for Investigator (Horticultural and Pathological) . . . . .	200	200	200	200	200	1,000
9	Reserve . . . . .	500	500	500	500	500	2,500
	<b>Total</b> . . . . .	<b>21,686</b>	<b>13,574</b>	<b>14,042</b>	<b>14,450</b>	<b>14,918</b>	<b>78,650</b>

(Signed) L. S. S. KUMAR,  
Acting Economic Botanist to Government,  
Bombay, Poona.

## APPENDIX XXI-A.

SUBJECT 22.—*Application from the Government of Bombay for a grant of Rs. 78,650 for the improvement of Papaya by breeding and cultural practices.*

*Report of the Fruit Research Sub-Committee (18th February 1935).*

*Present :*

Mr. B. C. Burt, *Chairman*,  
 Mr. R. C. Allan,  
 Mr. J. N. Chakravarty,  
 Mr. K. McLean,  
 Mr. A. M. Mustafa,  
 Mr. Narasimha Iyengar,  
 Dr. S. S. Nehru,  
 Mr. Nizamuddin Hyder,  
 Mr. B. S. Patel,  
 Mr. J. H. Ritchie,  
 Mr. D. R. Sethi,  
 Mr. H. B. Stewart,

The Sub-committee considers that several portions of the programme of work set out at page 2 of the scheme are already covered by work in progress elsewhere. A general horticultural study of the papaya is already included in the Bihar and United Provinces joint 'plains' fruit research schemes' now in progress at Sabour. Work in the extraction of papain has been carried out at the Harcourt Butler Technological Institute for some years and it is doubtful if more chemical work is really necessary whilst the problem of collar-rot appears to be more local than general.

The sub-committee does not consider that a comprehensive scheme of work is called for at present especially as there is some doubt whether the Papaya grows sufficiently normally outside the tropics to permit the carrying out of part of the programme put forward. It therefore recommends that a preliminary investigation on the cytology of the Papaya should be carried out with a view to a subsequent study of sex inheritance. For this purpose it would be sufficient to provide an Assistant on Rs. 110—8—150 and to give a grant of Rs. 1,500 for special apparatus. The cost of the scheme would then come to about Rs. 5,748 or say Rs. 6,000 roundly spread over a period of three years. The sub-committee considers this period sufficient to enable preliminary results to be obtained and a decision reached as to whether the investigation should be further pursued. The Assistant to be appointed should have at least a good M.Sc. degree with post-graduate training in cytology. The sub-committee notes that the Government of Bombay did not offer to contribute anything towards the finances of the original scheme. It is the view of the sub-committee that the Local Government should provide all the laboratory facilities required and any other non-recurring and recurring expenditure which the modified scheme now recommended may involve.

B. C. BURT,

DELHI;

*The 18th February 1935.*

## APPENDIX XXII.

NOTE DATED THE 2ND FEBRUARY 1935, BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT No. 4:—RECOMMENDATIONS OF THE LOCUST COMMITTEE AT ITS SIXTH MEETING HELD IN JANUARY 1935. PROPOSALS FOR CONTINUANCE AND FUTURE PROGRAMME OF WORK.

At its meeting held in February 1934 the Advisory Board approved of the recommendations of the fifth meeting of the Locust Committee for the extension of locust Research work during the year 1934-35 and the lines on which that work should be carried on.

These recommendations were sanctioned by the Governing Body and work has been carried on accordingly during the year 1934-35.

2. The present sanction for the scheme expires on the 31st March 1935. The Locust Committee met on the 17th and 18th January 1935 in order to review the progress of the work done during the year under the Locust Research Entomologist and the Assistant Locust Research Entomologist and Mr. Afzal Hussain (Lyallpur) and to consider the future of the two schemes. Attention is invited to the reports of the work done by the Locust Research Entomologist, Assistant Locust Research Entomologist and Mr. Afzal Hussain and other relevant papers circulated to the Committee at its last meeting (not printed). It will be seen from the proceedings of the Locust Committee (not printed) that the Committee recommends the continuance of the Locust Research Scheme for another year with effect from 1st April 1935 and has made the following recommendations on the more important points of detail:—

- (i) that the extensive survey work was of less importance than the intensive survey and that the work in Sind should be limited to the desert area in Thar Parkar District and that intensive work should be carried out at three or four centres with two Fieldmen at each the Locust Research Entomologist was instructed to draw up a scheme for the intensive survey work and submit it to the Council's Secretariat for final orders.
- (ii) that the work at Pasni and Anibagh should be continued.
- (iii) that the survey Assistant already stationed at Karachi should be replaced by a Biologically qualified man on Rs. 125 p. m., his headquarters being fixed by the Locust Research Entomologist and the work being supervised by him.
- (iv) that the Locust Research Entomologist should be given for a period of six months in the first instance, a Biometrical Assistant on a pay of Rs. 80 per mensem plus Karachi allowance.
- (v) that a draftsman be appointed for mapping work on a pay of Rs. 45 per mensem plus Karachi allowance.
- (vi) that the rate of annual increments for Messrs. Mohd. Ramzan, Chandra Prakash and Shanti Lal be increased from Rs. 2 to Rs. 4.

3. As regards the work at Lyallpur under Mr. Afzal Hussain the Committee recommended that the grant of about Rs. 6,000 asked for the continuance of the locust research scheme for the study of the Biology and Bionomics of the desert locust conducted at Lyallpur under the supervision of Mr. Afzal Hussain, Entomologist to Government Punjab, be sanctioned on the following conditions:—

- (i) that the primary object of this grant will be to compile the data already collected and to publish it in such form as might be decided upon by the Council;
- (ii) that there should be no objection to Mr. Afzal Hussain carrying out any experiments that may be required for filling up gaps in this scheme provided they do not interfere with the compilation work referred to in (i) above;
- (iii) that in view of the difference of opinion in the Committee as to whether the final report should be published in the form of a monograph or in a series of articles, the matter should be placed before the Advisory Board at its next meeting and that Mr. Afzal Hussain should be invited to attend the meeting and state his case before the Board;



(iv) that if this work is to be continued any further, it should come up as a fresh application for a grant from the Council, through the Punjab Government and its research Committee.

4. The total cost of continuance of the schemes during the year 1935-36 as recommended by the Committee is estimated at Rs. 80,313, i.e., Rs. 74,313 for the research scheme under the Locust Research Entomologist and Rs. 6,000 for the work on the Biology and Bionomics of the desert locust to be carried out at Lyallpur (Annexure). If the recommendations of the Locust Committee are approved by the Advisory Board sanction of the Governing Body will be obtained by circulation.

It will be seen from Appendix V to the note (not printed) circulated to the Locust Committee that the total cost of the Locust Research Scheme up to the end of the year 1934-35 will come to about Rs. 3,76,380-8-8.

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

### ANNEXURE.

BUDGET ESTIMATES OF THE OFFICE OF THE LOCUST RESEARCH ENTOMOLOGIST TO THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, KARACHI, FOR THE YEAR 1935-36.

#### A.—HEADQUARTERS—

	Rs.
1. Pay of officer (Locust Research Entomologist) at Rs. 1,000) per mensem . . . . .	12,000
2. Pay of Establishment :—	
1 Locust Research Assistant on Rs. 125 per mensem . . . . .	1,500
1 Head Clerk on Rs. 130 upto 8th June 1935 and 140 from 9th June 1935 . . . . .	1,658
1 Second clerk on Rs. 56 per mensem . . . . .	672
1 Biometrical Assistant on Rs. 80 per mensem for six months . . . . .	480
1 Draftsman on Rs. 45 per mensem . . . . .	540
1 Typist on Rs. 39 per mensem . . . . .	468
2 Compiling Assistants at Rs. 71 per mensem each . . . . .	1,704
2 Fieldmen on Rs. 32 per mensem each . . . . .	768
1 Lorry Allowance to a Fieldman at Rs. 10 . . . . .	120
1 Peon at Rs. 18 per mensem . . . . .	216
2 Peons on Rs. 17 per mensem each . . . . .	408
	8,534

#### II.—Allowances, Honoraria, etc.

1. House Rent and other allowances :—	
(a) Officer (L. R. E., Karachi) at Rs. 60 per mensem . . . . .	720
(b) Establishment . . . . .	1,280
2. Travelling Allowance :—	
(a) Officers . . . . .	2,500
(b) Establishment . . . . .	1,500

#### III.—Contingencies, etc

Contingencie Supplies and Services . . . . .	4,000
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IV.—*Grants-in-aid, etc.*

	Rs.
Leave and Pension Contributions :—	
(a) Officers . . . . .	2,760
(b) Establishment . . . . .	608
	<hr/>
Grand total for A.—Headquarters	33,902

## B.—SURVEY PARTY—

I.—*Pay.*

## Pay of Establishment :—

1 Locust Research Assistant on Rs. 350 upto 7th June and Rs. 364 from 8th June 1935 . . . . .	4,337
1 Locust Research Assistant on Rs. 170 per mensem . . . . .	2,040
2 Fieldmen on Rs. 32 per mensem each . . . . .	768
5 Fieldmen on Rs. 31 per mensem each . . . . .	1,860
8 Messengers on Rs. 12 per mensem each . . . . .	1,152
2 Peons on Rs. 15 per mensem each . . . . .	360
	<hr/>
	10,517

II.—*Allowances, Honoraria, etc.*

1 House Rent and Other Allowance to Establishment . . . . .	144
2. Travelling allowance of Establishment . . . . .	4,000

III.—*Contingencies, etc*

Contingencies, Supplies and Services . . . . .	3,000
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IV.—*Grants-in-aid, etc.*

Leave and Pension contributions for Mr. Keshodas Baweja . . . . .	834
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Grand total for B.—Survey Party . . . . .	<hr/> 18,495
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## C.—PASNI—

I.—*Pay.*

## Pay of establishment :—

## 1. Pasni—

	Rs.
1 Assistant Locust Research Entomologist on Rs. 390 per mensem . . . . .	4,680
1 Locust Research Assistant on Rs. 170 . . . . .	2,040
1 Clerk on Rs. 54 per mensem . . . . .	648
4 Fieldmen on Rs. 42 per mensem each . . . . .	2,016
2 Fieldmen on Rs. 22 per mensem each . . . . .	528
3 Messengers at Rs. 12 per mensem each . . . . .	432
1 Peon at Rs. 18 per mensem . . . . .	216
1 Water Carrier at Rs. 10 per mensem . . . . .	120
	<hr/>
	10,68

## I.—Pay—contd.

	Rs.	Rs.
2. Ambagh—		
1 Locust Research Assistant on Rs. 135 per mensem	1,620	
2 Fieldmen on Rs. 41 per mensem each	984	
1 Fieldman on Rs. 31 per mensem	372	
1 Peon on Rs. 18 per mensem	216	
1 Messenger on Rs. 12 per mensem	144	
	3,336	

## II.—Allowances, Honoraria, etc.

1. Compensatory Local Allowance to 1 Locust Research Assistant at Pasni at Rs. 75 per mensem	900
2. Travelling allowance of establishment	4,000

## III.—Contingencies, etc.

Contingencies, Supplies and Services	3,000
Grand total for C.—Pasni	21,916

*Summary.*

Main Scheme—	
A.—Headquarters	33,902
B.—Survey Party	18,495
C.—Pasni	21,916
	74,313
Punjab Locust Research Scheme	6,000
Grand total	80,313

## APPENDIX XXIII.

NOTE DATED THE 2ND FEBRUARY 1935, BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT No. 18 :—REFERENCE FROM THE PUBLIC HEALTH COMMISSIONER TO THE GOVERNMENT OF INDIA, REGARDING A PROPOSAL FROM MAJOR-GENERAL SIR R. MCCARRISON, KT., C.I.E., K.H.P., I.M.S., DIRECTOR, NUTRITION RESEARCH, INDIAN RESEARCH FUND ASSOCIATION, FOR A SURVEY OF FOOD-MATERIAL AND THEIR FOOD VALUES THROUGHOUT INDIA.

Attention is invited to the attached letter (Annexure I) from the Public Health Commissioner to the Government of India forwarding a note (Annexure II) of the scheme prepared by Major-General Sir Robert McCarrison on the subject mentioned above. The scheme was circulated to the Advisory Board as part of Annexure IV to the notes dated 1st September 1934 by the Secretary, Imperial Council of Agricultural Research, on the subject No. 30 on the Agenda for the meeting of the Advisory Board held in September 1934.

2. It is now for the consideration of the Advisory Board as to what extent the Provincial Agricultural Departments and their laboratories will be able to co-operate in collecting the information and specimens and conducting the analyses which Major-General Sir Robert McCarrison suggests and to what extent, if any, they will require additional staff.

## ANNEXURE I.

COPY OF LETTER No. 262/555, DATED THE 28TH JANUARY 1935, FROM THE PUBLIC HEALTH COMMISSIONER WITH THE GOVERNMENT OF INDIA, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH DEPARTMENT.

In accordance with the arrangement made with the Agricultural Expert at the informal conference held with him and Colonel Oliver, C.B., C.M.G., on the 24th instant, I am sending herewith a note on Major General McCarrison's scheme for a survey of food-materials and food-values throughout India for presentation to, and discussion with, the Advisory Board of the Imperial Council of Agricultural Research at its meeting on 18th February 1935.

I have not gone into any detail in connection with Major General McCarrison's scheme, because I understand that it has already been circulated to all members of the Advisory Board.

## ANNEXURE II.

The Indian Research Fund Association have for some time held the opinion that a survey of the food-materials of India is desirable, but have been unable to provide the funds required for carrying out this large enquiry. Major General McCarrison, who has repeatedly urged the importance of such a survey, has included, in the Nutritional Research budget for 1935-36, provision for the employment of two chemists to be stationed at the Nutritional Research Laboratories, Coonoor, and to commence the analysis of the food-stuffs of Southern India. The Scientific Advisory Board, I. R. F. A., has recommended this scheme and it will be placed before the Governing Body, I. R. F. A., at its meeting on 2nd March. This small scheme, however, even if it is accepted by the Governing Body, I. R. F. A., can only be looked on as a preliminary to a much larger one and in order that the complete project may be brought to wider notice, the present note has been prepared as a basis for discussion at the Imperial Council of Agricultural Research Advisory Committee's meeting and at the forthcoming meeting of the Governing Body, I. R. F. A.

2. A survey of food-materials throughout India is obviously one with which Agricultural and Public Health Departments are intimately concerned. It is to these Provincial Departments therefore, that we must look for assistance in preparing a complete list of "all food-materials, however, rare their use may be, entering into the dietaries of the people of each presidency or province". It is suggested: (i) that the various Public Health Departments should be addressed asking them to catalogue, in co-operation and in consultation with their respective provincial Agricultural Departments, all foodstuffs used in their provinces—the catalogue might be drawn up according to the classification given in Major General McCarrison's note: (ii) that the same Departments should also document all available information in connection with analyses of food-stuffs already made; and (iii) that they should give details of any special investigation of the kind now in progress. When complete, information on these three points might then be forwarded to the Public Health Commissioner with the Government of India, who is also Secretary of the Indian Research Fund Association.

3. The I. R. F. Association, it is feared, cannot under present financial conditions hope to expand the scheme to all parts of British India without assistance from the Agricultural Department of each province. It is understood that there are some nine agricultural laboratories situated in different provinces of India where chemists could possibly be accommodated and given laboratory facilities. In addition accommodation for additional chemist might be found at the Central Research Institute, Kasauli, at the All-India Institute of Hygiene and Public Health, Calcutta, at the Pasteur Institute, Shillong, etc., although perhaps it might be more suitable to attach these chemists only to agricultural laboratories in order that they have the benefit of supervision by officers accustomed to deal with such analyses as they would be required to make.

4. I understand that the rate of pay viz., Rs. 150 per mensem, suggested by Major General McCarrison, would be sufficient to attract well-qualified chemists. Should provincial agricultural chemists be willing to co-operate, and it is understood that the

I. C. A. R. would endeavour to obtain this co-operation,—the estimated cost per annum for each chemist may be calculated as follows:—

	Rs.
Pay . . . . .	1,800
Pay of attendant . . . . .	200
Contingencies . . . . .	500
	2,500

Although apparatus and a certain amount of chemicals would be available in the provincial agricultural laboratories, the contingencies allotment of Rs. 500 would probably meet all additional requirements in this direction.

5. A further point which requires mention is the fact that the analyses of food-stuffs grown in different parts of the same province would almost certainly vary to a greater or less extent. For instance, if in certain areas mineral deficiencies existed, vegetables, grain, etc., grown in these areas would present different figures for mineral constituents. This would imply that analyses of food-stuffs from one district could not necessarily be taken as representative of the same food-stuffs grown in other districts of the province, so that a series of samples of the same food would require examination. In the same connection biochemical work is important and the I. R. F. Association and its Director of Nutritional Research would welcome all information which the I. C. A. R. at Muktesar and elsewhere might have at its disposal.

6. Major-General McCarrison's proposal to employ a supervising chemist does not seem to be necessary if provincial agricultural laboratories are prepared to co-operate to the extent outlined in previous paragraphs, but it seems desirable that some experienced officer should be placed in supervisory charge and probably Major General McCarrison's successor, shortly to be appointed, would be a suitable officer in this connection. It is not proposed that he should tour throughout India supervising and inspecting the work done by individual chemists. This would be obtained, it is hoped, in the provincial agricultural laboratories in which they are working. But the Director, Nutritional Research, is probably the most suitable officer for co-ordination of the work and it is suggested that all reports of analyses, etc. should be submitted to him as the work proceeds. It will also be the Director of Nutrition who should issue a report containing tables of food values for the whole of India after the work has been completed.

7. Nor do I think that it would be possible, as Major General McCarrison envisages, for the whole work to be completed throughout India in a year or two. As I have already said it is probable that as the work proceeded additional analyses would have to be undertaken, and it is therefore likely that the scheme would not be completed for a number of years.

8. This, however, need not I think be used as an argument against early action. Surveys of food-materials and their food-values are already being carried out in a number of Eastern countries. During my recent visit to China, I found that the Chinese National Government had a scheme in force and a considerable amount of information on the subject was already available. A similar scheme in the Federated Malay States has already provided a considerable amount of information, whilst in Japan work of the same kind has been done for some time. All these Governments have found it desirable to be in possession of the information made available by food surveys, and there can be no doubt that similar work should be undertaken in India without further delay. In my opinion the time has come when, with the co-operation of the I. C. A. R. and the Agricultural and Public Health Departments all over India, this scheme should be initiated and carried to completion as quickly as funds will permit.

## APPENDIX XXIV.

REPORT OF THE RICE SUB-COMMITTEE APPOINTED TO CONSIDER RICE RESEARCH SCHEMES  
PROGRESS REPORTS, 1933-34 (21ST FEBRUARY).*Present :*

Diwan Bahadur Sir T. Vijayaraghavacharya, K.B.E., *Chairman.*  
 Mr. R. G. Allan.  
 Professor S. P. Agharkar.  
 Mr. B. C. Burt.  
 Mr. P. H. Carpenter.  
 Mr. J. W. Grant.  
 Mr. K. McLean.  
 Professor P. K. Parija.  
 Mr. B. S. Patel.  
 Mr. K. Ramiah.  
 Mr. J. H. Ritchie.  
 Mr. D. R. Sethi.  
 Dr. F. J. F. Shaw.  
 Mr. Thompson.  
 Mr. M. Vaidyanathan.  
 Rao Bahadur B. Viswanath.

The sub-committee first took into consideration the report of the Bengal rice research scheme and many of their observations on this progress report are of a general character and will not be repeated in regard to other schemes although they are applicable to them in several instances. The sub-committee considers it desirable that there should be some general standard size of report. Whilst an adequate technical report is desired, too voluminous a report tends to defeat criticism. It is suggested that the future standard should be 30 pages of print as a maximum; when necessary, important tables may be added as an appendix. The detailed data of the results of field experiments should be supplied to the Council's Statistician but should not be included in the printed report.

After some discussion as to the amount of labour involved in the statistical working out of results, the sub-committee recorded the general view that the staff employed on each scheme is sufficient to deal with its own statistical work, provided that too many formal yield trials are not undertaken. From every point of view, it is desirable that the distinction between observation plots and elaborate yield trials should be observed and that the latter should not be started prematurely. Generally speaking, the Burma progress report was considered to be a suitable model for all reports on rice research schemes. In variety testing and some other field experiments, the first two years' experiments are preliminary, the third year's experiments should be rigid yield trials properly laid out.

The sub-committee was also of opinion that there should be uniformity in the use of certain terms in the reports and it is provisionally suggested that the word 'variety' should be reserved for a commercial or agricultural variety and the term 'strain' reserved for strains multiplied at a plant-breeding station from single plant cultures. The term 'pure line' should be reserved for strains which have been demonstrated to be pure lines in the strict botanical sense and such should be fully described under type numbers. The term 'single plant culture' is a suitable description for such cultures whilst under study. Before prescribing the terms to be used in future reports, it is desirable that the Imperial Bureau of Plant Genetics should be consulted, in order that the accepted international nomenclature may be followed.

The Marketing Adviser pointed out that price differences in relation to quality would be an important matter in the conduct of marketing surveys and he would be grateful if various rice research stations would undertake to test samples supplied by his officers for hulling percentage, fineness of grain and if possible, breakage and

similar grain characters. It was agreed that each research station should be asked to do the Marketing Officers' samples for its own province. It was agreed that the proposal that the Marketing officers should visit the various research stations, was a sound one.

SUBJECT No. 5.—*Annual report on the rice research stations, Bankura and Chinsura, (Bengal, 1933-34).* (Appendix XXIV-A.)

*Bankura rice farm research programme.*

It was noted that the lay-out adopted this year satisfies the Statistician to the Research Council as the best practicable in difficult circumstances. As regards certain field experiments, the sub-Committee desires to point out that the results obtained when paddy is dibbled bear no relation to the yields which may be obtained when the seed is broadcasted. In the experiment described on pages 31-32 of the Bankura report, it was noticed that the date of transplanting was too late for the varieties used. As regards the experiment described on pages 40-41 of the report it was pointed out that the records for parent plants grown in the field are not comparable with those of F<sub>1</sub> plants grown in pots.

*Chinsura.*

Although the point does not arise on this report, the Sub-Committee desires to point out that complex experiments are not, as a rule, suited to differential irrigation. In general there is used for a clear realisation of the limitations of "complex" field experiments where cultural and experimental difficulties are considerable. There is need for much more information as to the conditions in which such experiments can be successfully employed. The Sub-Committee also desires to emphasise the importance of all research officers on such schemes having an adequate knowledge of statistics to enable them to plan their experiments properly and understand the statistical interpretation of them.

SUBJECT No. 6.—*Annual report on the working of the rice research scheme in Burma, 1933-34.* (Appendix XXIV-B)..

The Sub-Committee approved of the report which it considered was very well presented. Mr. Grant stated that two selections from Burma rices which matched the Carolina type of rice imported into Europe, viz., A28-6 and A26-3 were now being grown on a considerable scale and the cultivators got a premium of 20 per cent. on the price of paddy on account of quality. Five hundred tons of each of these varieties were shipped to Canada and the United Kingdom respectively last year.

The more important of the new crosses now under study included an attempt to match the well known Blue Rose 'bold' type of American rice which has a shorter grain than the Carolina type and which mills better. The object of these experiments is to obtain a type suitable for the Continent of Europe where Burma has lost a great deal of its rice export trade owing to competition from America, Spain and Italy. In addition, a hybrid between the Medou type of Burma rice and a somewhat similar Japanese rice which is translucent instead of being starchy, has been studied with a view to obtaining a translucent Medon type similar to the Japanese type.

SUBJECT No. 7.—*Annual reports on the working of the rice research schemes in Madras and United Provinces, 1933-34, and in the Central Provinces for the period September 1933 March 1934.* (Appendix XXIV-C.)

(i) *Madras.*—The general point was raised that some rice research officers were not being granted permission by their local governments to visit rice research stations in other provinces. The sub-committee desires to emphasise the fact that it was one of the conditions on which these grants were made by the Council that such facilities would be given. The Paddy Specialist in Madras is not paid from the Council's grant as in that province most of the rice research is financed provisionally. But his visit to Burma and other provinces would be to the rice work generally and there would be no objection to his travelling allowance being charged to the Council's rice research grant. The sub-committee considers that the experiments on the manuring

of paddy seed-beds should be continued and such manuring has given very satisfactory results in Burma where the application of 100 lbs of Niciphos per acre in the plants nursery has led to a statistically significant increase of 180 lbs per acre of rice in the field—which means 1,800 lbs per acre from the 10 acres which one acre of nursery supplied. Similar successful results have been obtained in the Central Provinces. The question of trans-planting on an equal growth basis as well as an equal number of tests after sowing will be borne in mind. The sub-committee notes that Berhampore station will eventually be transferred to the new province of Orissa. The Paddy Specialist, Madras, explained that this possibility was allowed for in the programme of the station and at the end of five years some improved varieties would probably be ready for handing over.

(ii) *United Provinces*.—The Director of Agriculture accepted the criticisms and suggestions made by the Statistician and these will be conveyed to the officer in charge of the research scheme.

As regards the question raised on pages 41 and 42 of the report, it was agreed that a reasonable size for such experimental plots for broadcast rice would be 1/40th of an acre. The Sub-Committee had no further comments to make on the report.

(iii) *Central Provinces*.—The Director of Agriculture accepted the Statistician's suggestions as detailed in his supplementary note. In several instances more replications would have been arranged had sufficient uniform land been available. The Sub-Committee suggested that in this report, as indeed in all others, it was desirable that each year a programme of work should be given showing especially what modifications were being made in the light of experience since gained in field experiments. The report was accepted.

*Scheme for the extension of work on "quality" in crops by the Indian Institute of Science, Bangalore. (Appendix XXIV-D).*

The technical programme of work to be carried out on "quality" in rice submitted in accordance with the decision of Advisory Board, February 1934 was considered by the Sub-Committee and approved.

B. C. BURT.

DELHI;  
The 21st February 1935.



## APPENDIX XXIV-V.

NOTE DATED THE 28TH JANUARY 1935 BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT No. 5. ANNUAL REPORT ON THE RICE RESEARCH STATIONS, BANKURA AND CHINSURA (BENGAL) FOR THE YEAR 1933-34.

The second annual report (not printed) on the rice research scheme in Bengal, for the year 1933-34, is submitted for the consideration of the Advisory Board. The first report (for 1932-33) was considered by the Board at its meeting held in February 1934 (*vide* printed proceedings of the Board, pages 39-40 and 400-432). The suggestions made by the Sub-Committee which examined that report (pages 400-401 of printed proceedings) were communicated to the Government of Bengal, and a report (Annexure) by the Rice Research Officer, Bankura, showing the action taken by him thereon which has been received through the local Government is also enclosed.

2. The subject will as usual be examined first by a sub-committee of the Board consisting of :—

1. The Vice-Chairman, Imperial Council of Agricultural Research, Chairman *ex-officio*.
2. The Agricultural Expert, Imperial Council of Agricultural Research.
- 3—7. The Directors of Agriculture, Madras, Bombay, Bengal, United Provinces, and Bihar and Orissa.
8. Dr. F. J. F. Shaw, Director, Imperial Institute of Agricultural Research, Pusa.
9. R.B. B. Viswanath, Imperial Agricultural Chemist (Subject to the approval of the Government of India).
10. Prof. P. K. Parija, Ravenshaw College, Cuttack (Subject to the approval of the Government of Bihar and Orissa).
11. Mr. K. Ramiah, Paddy Specialist, Madras (Subject to the approval of the Government of Madras)
12. Mr. M. Vaidyanathan, Statistician, Imperial Council of Agricultural Research.

Secretary, Imperial Council of Agricultural Research, Secretary *ex-officio*.

The Sub-Committee will meet on an afternoon between the 18th and 23rd February 1935 and its report will be submitted to the Board in due course.

## ANNEXURE.

COPY OF LETTER No. 203/31, DATED THE 14TH JULY, 1934, FROM THE RICE RESEARCH OFFICER, BANKURA, TO THE ECONOMIC BOTANIST, BENGAL.

With reference to your memo. No. 996-98/78, dated the 23rd June 1934, I have the honour to submit that the instructions and recommendations of the sub-committee of the Advisory Board to the Imperial Council of Agricultural Research, conveyed in your Memo. under reference are being followed. Items III and IV have been discarded." Items I, II, V, VI, VII(1) and VIII(2) have been continued and the results have been submitted in the Annual Report for the year 1933-34.

Item VII(3) refers to the data obtained from the Uniformity trial conducted in 1932-33. This was discussed thoroughly with the Statistician when he visited Bankura. The data have been forwarded to the Statistician for analysis and his report on them is awaited.

The interpretation of water requirement as laid down in the note is the correct one.

## APPENDIX XXIV-B.

NOTE DATED THE 26TH JANUARY 1935 BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT No. 6.—ANNUAL REPORT ON THE WORKING OF THE RICE RESEARCH SCHEME IN BURMA FOR THE YEAR 1933-34.

The second annual report (not printed) of the Rice Research Officer, Burma, for the year 1933-34, is submitted for the consideration of the Advisory Board. The first report was considered by the Board at its meetings held in February 1934 (*vide* pages 39-40 and 400—432 of the printed proceedings of the Board).

2. The report will, as usual, be examined first by a Sub-Committee of the Board consisting of:—

- (1) The Vice-Chairman, Imperial Council of Agricultural Research, Chairman (*ex-officio*).
- (2) The Agricultural Expert, Imperial Council of Agricultural Research.
- (3) The Director of Agriculture, Madras.
- (4) The Director of Agriculture, Bombay.
- (5) The Director of Agriculture, Bengal.
- (6) The Director of Agriculture, United Provinces.
- (7) The Director of Agriculture, Bihar and Orissa.
- (8) The Director, Imperial Institute of Agricultural Research.
- (9) R.B. B. Viswanath, Imperial Agricultural Chemist, Imperial Institute of Agricultural Research. (Subject to the approval of the Government of India).
- (10) Mr. P. K. Parija, Ravenshaw College, Cuttack (Subject to the approval of the Bihar and Orissa Government).
- (11) Mr. K. Ramiah, Paddy Specialist, Madras. (Subject to approval of the Government of Madras).
- (12) Mr. M. Vaidyanathan, Statistician, Imperial Council of Agricultural Research.

Secretary, Imperial Council of Agricultural Research, Secretary *ex-officio*.

The Sub-Committee will meet on an afternoon between the 18th and 23rd February 1935 and its report will be submitted to the Board in due course.

## APPENDIX XXIV-C.

NOTE DATED THE 23RD JULY 1934 BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT NO. 7: ANNUAL REPORTS ON THE WORKING OF THE RICE RESEARCH SCHEMES IN MADRAS AND THE UNITED PROVINCES (1933-34) AND THE CENTRAL PROVINCES (SEPTEMBER 1932 TO MARCH 1934).

A co-ordinated scheme of rice research in the provinces of Madras, Bengal, United Provinces, Burma, Bihar and Orissa, Central Provinces and Assam was sanctioned by the Council in May 1931. Details of the various provincial schemes will be found in Appendices XV (pages 103—133) and V (pages 77—81) of the printed proceedings of the meetings of the Advisory Board held in June 1930 and January 1931, respectively. The first progress reports on the working of the Madras, United Provinces and Bihar and Orissa schemes were placed before the Board at its meeting held in August 1933 and those of the Bengal and Burma schemes at the Board's meeting held in February 1934.

2. The second progress reports (1933-34) for the Madras and the United Provinces Schemes and the first progress report (for the period September 1932 to March 1934) for the Central Provinces Scheme, have now been received and are for the consideration of the Advisory Board.

As in the case of the earlier progress reports, these reports will also be examined first by a Sub-Committee consisting of the following gentlemen:—

1. The Vice-Chairman, Imperial Council of Agricultural Research (Chairman *ex-officio*).
2. The Agricultural Expert, Imperial Council of Agricultural Research.
3. The Director of Agriculture, Madras (or representative of the Agricultural Department).
4. The Director of Agriculture, Bombay (or representative of the Agricultural Department).
5. The Director of Agriculture, Bengal (or representative of the Agricultural Department).
6. The Director of Agriculture, United Provinces (or representative of the Agricultural Department).
7. The Director of Agriculture, Burma (or representative of the Agricultural Department).
8. The Director of Agriculture, Bihar and Orissa (or representative of the Agricultural Department).
9. The Director of Agriculture, Central Provinces (or representative of the Agricultural Department).
10. Dr. F. J. F. Shaw, Director, Imperial Institute of Agricultural Research, Pusa.
11. Rao Bahadur B. Viswanath.
12. Professor P. K. Parija, Ravenshaw College, Cuttack.
13. Dr. J. C. Ghosh.
14. Mr. M. Vaidyanathan, Statistician, Imperial Council of Agricultural Research.

Secretary, Imperial Council of Agricultural Research, Secretary, *ex-officio*.

The Sub-Committee will meet on an afternoon on the occasion of the Board's meeting and the report of the Sub-Committee will thereafter be placed before the Board.

## APPENDIX XXIV—D.

MEMORANDUM FROM THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. F-351/34/A., DATED NEW DELHI, THE 16TH FEBRUARY 1935, TO ALL MEMBERS OF THE RICE COMMITTEE OF THE ADVISORY BOARD, FEBRUARY 1935.

The undersigned is directed to say that a scheme submitted by the Indian Institute of Science, Bangalore, for extension of work on "quality" in crops was considered and recommended for sanction by the Advisory Board at its meeting held on the 25th January 1932 (pages 3 and 44-47 of the printed proceedings). The Governing Body accepted the recommendation of the Advisory Board at its meeting held on the 6th October, 1932, (pages 10 and 11 of the printed proceedings). It was only possible to give financial sanction to the scheme in November 1934—in accordance with the priority list approved by the Governing Body, (*vide* Appendix II of the proceedings of the Governing Body's meeting held in November 1933). When financial sanction was communicated, the Institute was asked to furnish a full technical programme of work, in accordance with the decision of the Advisory Board reached at its meeting held in February 1934 (pages 39 and 40 of the printed proceedings). The technical programme (Enclosure) which has now been received from the Institute is for the consideration of the Committee.

## ENCLOSURE.

*The Programme of Work on "Quality in Rice".*

The programme of immediate research can be roughly divided into two parts—(1) investigation into the conditions of storage of paddy and the changes taking place during storage and (2) investigation into the methods of parboiling with a view to standardising the conditions and to place the present-day empirical method on a scientific basis so as to improve the quality of the marketable product.

(1) *Storage of paddy.*—Rice is generally stored in the form of paddy. The storage of milled rice is adopted only to a very small extent. The methods of storage at present in use (in the Madras Presidency) group themselves under two heads:—(i) storage in granaries under aerobic conditions and (ii) storage in underground hermetically sealed pits where anaerobic conditions may exist. The latter process is supposed to hasten the changes taking place during storing as judged by the shortening of the period after which rice becomes suitable for consumption after hulling and milling.

It is proposed to store paddy under aerobic and anaerobic conditions and follow the chemical changes at definite intervals.

The changes in the chemical composition of paddy during storage may be assumed to be in continuation of those taking place during the ripening and setting of the rice grain. The progressive conversion of saccharide material into amylose and amylopectin, the two important constituents of starch in the rice grain may still be continued when the grain has been harvested and kept in storage, and it is probable that it is the extent of this conversion that largely determines the edible quality of rice. Investigation of this aspect of the question is to be taken in hand immediately.

The differences, if any, in the nutritive values of early and late, white and coloured rices will also be investigated.

Rices which have been milled to such an extent that their vitamin B<sub>1</sub> contents have been reduced to nil, will be fed to rats with an extraneous source of vitamin B<sub>1</sub> to bring out any differences in the nutritive value of such rices due to factors other than their vitamin content.

(2) *Parboiling of Paddy.*—Parboiling is practised in various parts of the country and the methods in use vary according to the locality. The essentials of the process may be outlined as follows:—The paddy is steeped in water for a period varying from 24 to 72 hours. The temperature of the soak water varies in different localities as also the period of soaking, after soaking the paddy is placed in pots and steamed with boiling water underneath it or by letting in live steam. If the steam is let under pressure, steaming is complete within ten to fifteen minutes, otherwise steaming by boiling may have to be continued for two hours. After steaming, the grain is spread out to dry, the period of drying depending upon the availability of sunlight.

From the information available, it seems that the process is followed along highly empirical methods. Any one of the factors involved from steeping upto drying may affect the quality of the final product both as regards its edibility and marketability. Hence a thorough investigation into this aspect is under immediate consideration.

It is proposed to control parboiling by varying the methods of steeping, steaming and drying and finding out the effect of such variation upon the final product. Under steeping one can vary the temperature of water and the period of soaking; similarly steaming can be done at different known pressures, and sun-drying can be compared with oven-drying as regards its suitability.

The effects of these controlled variations will be tested by chemical analysis and by feeding experiments on rats.

In consultation with the Paddy Specialist to the Government of Madras, it has been decided to confine the investigation to two early varieties and two late varieties of known strains; of the two early varieties chosen for experiment, one is coloured red.

Most of the work outlined can be undertaken simultaneously. This programme of work should naturally allow for certain alterations and modifications which would depend upon the experimental results obtained during the progress of the investigation.

Indian Institute of Science,

Bangalore, 22nd January 1935.

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## APPENDIX XXV.

REPORT OF THE AGRICULTURAL METEOROLOGY SUB-COMMITTEE, 21ST FEBRUARY, 1934.

## PRESENT :

Dewan Bahadur Sir T. Vijayaraghavacharya, K.B.E., *Chairman*.  
 Prof. S. P. Agharkar,  
 Mr. B. C. Burt,  
 Mr. P. H. Carpenter,  
 Mr. J. N. Chakrabarti,  
 Dr. T. Ekambaram,  
 Mr. K. McLean,  
 Dr. B. Narasimha Iyenger,  
 Dr. Nazir Ahmad,  
 Mr. Nizam-ud-din Hyder,  
 Mr. B. S. Patel,  
 Mr. K. P. Pillai,  
 Dr. L. A. Ramdas,  
 Mr. J. H. Ritchie,  
 Mr. D. R. Sethi,  
 Dr. F. J. F. Shaw,  
 Mr. H. R. Stewart,  
 Rao Bahadur B. Viswanath,  
 Mr. K. K. Warrior.

SUBJECT 9:—*Annual report on the working of the Agricultural Meteorology Branch, Poona, for the 2nd year ending 21st August 1934. (Appendix XXVI).*

Dr. Ramdas, Agricultural Meteorologist, attended the Sub-Committee and discussed details of his work with members.

*Frost warnings.*—It was explained that warnings can now be supplied to any part of India on request which should state the period for which the warnings are required. Warnings are issued by the Meteorological Department proper and a small fee probably about Rs. 10 per mensem, would be required for the telegraphic advices. It was noted by the Sub-Committee that for Northern India in general frost warnings would be required from 1st December to the end of February.

Experimental work on different types of evaporimeters has been particularly useful.

In the statistical section, the Sub-Committee considers that attention should be concentrated on items (B) and (D) of the programme stated on page 9. It is unlikely that the correlation with meteorological data of the gross crop yields recorded in the season and crop reports would lead to any useful results as the estimates of outturn contained in those reports are liable to such very large errors. On the other hand, the areas sown are known with considerable accuracy in many provinces and in these instances correlations between area and weather factors are justified as are correlations between the crop yields recorded at experimental stations and meteorological data.

With regard to item (5) on page 11, it is not considered that an attempt to correlate the soil temperatures recorded at Colaba with crop statistics in the neighbouring tracts would lead to any useful results. This does not detract from the value of the statistical study of the records themselves. The previous remarks also refer to the last sentence of item (7). The portable standard Thermo-couple set referred to at page 2 of the report has been of practical use at the Bihar sugarcane experimental station.

The Sub-Committee agreed that good work has been done which is of practical value to agriculture and which should be continued. The Sub-Committee attaches most importance to work on micro-climatology which really amounts to the accurate measurement and precise expression of the ecological factors which are so important to plant growth and pest control. Such work is also of value in leading to an understanding of the conditions which determine the infection of plants by diseases.

**SUBJECT 32** :—*Application from the Director-General of Observatories, Poona, for a grant of Rs. 1,39,000 for a revision and extension of the present scheme of agricultural meteorology already sanctioned by the Imperial Council of Agricultural Research. (Appendix XXXIX).*

The Sub-Committee is of opinion that this work should be continued and that the Agricultural Meteorological Section should eventually become a permanent establishment. The scheme was sanctioned for a five-year period in the first instance and the Sub-Committee recommends that it be continued for the remaining two year period of the present sanction. The Sub-Committee notes that the grant already sanctioned by the Governing Body is sufficient to finance the scheme for a total period of eight years in the outset.

The Sub-Committee approves of the small additions which it is now proposed to make under staff and contingencies; these are well within the original sanction. The Sub-Committee considers that it would be appropriate if the Professional Assistant were now given gazetted rank as his pay and position correspond with that of junior gazetted officers employed in provincial departments and on research schemes. The rates of pay proposed for clerks should be checked as usual in the Council's office to ensure that they correspond with the recognised Government rates.

B. C. BURT.

DELHI :

*The 21st February 1934.*

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## APPENDIX XXVI.

NOTE, DATED THE 29TH JANUARY 1935, BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT NO. 9.—ANNUAL REPORT OF THE AGRICULTURAL METEOROLOGY BRANCH FOR THE SECOND YEAR ENDING 21ST AUGUST 1934.

The second annual report (not printed) on the scheme of agricultural meteorology financed by the Council, for the year ended 21st August 1934, is submitted for the consideration of the Advisory Board. The first annual report on the scheme was considered by the Board at its meeting held in February 1934, *vide*, pages 41 and 451—462 of the printed proceedings of the Board. The suggestions made by the Sub-Committee of the Board which examined that report in the first instance (page 451) were communicated to the Director General of Observatories with the request that they should be adopted as far as possible and the attached letter, dated the 23rd June 1934 (Annexure I) received from him in that connection is for consideration. A copy of a reprint from the Report on the Administration of the Meteorological Department of the Government of India in 1933-34, relating to the agricultural Meteorology Branch, is also enclosed for information (Annexure II).

2. The report will first be examined by a Sub-Committee of the Board consisting of:—

1. The Vice-Chairman, Imperial Council of Agricultural Research, Chairman. (*ex-officio*).
2. The Agricultural Expert, Imperial Council of Agricultural Research.
3. All the Directors of Agriculture present.
4. The Director, Imperial Institute of Agricultural Research.
5. Imperial Agricultural Chemist (if in Delhi).
6. The Director, Indian Institute of Science, Bangalore.
7. Professor T. Ekambaram.

Secretary, Imperial Council of Agricultural Research, Secretary (*ex-officio*).

This committee will meet on an afternoon between the 18th and 23rd February 1935, and its report will be submitted to the Board in due course.

## ANNEXURE I.

COPY OF LETTER NO. 944/A, DATED THE 23RD JUNE 1934, FROM THE DIRECTOR GENERAL OF OBSERVATORIES, POONA, 5., TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA, S.W.

With reference to your letter No. F-57/1/33-Agr., dated the 5th May 1934, I have the honour to state that the suggestions of the Sub-Committee of the Advisory Board has been noted. The Agricultural Meteorology Branch has already been devoting the major part of its attention to the experimental side of work and to the statistical analysis and discussion of the interesting data that are being collected. The Statistical Section has also been investigating the data from experimental farms.

Instruments for measurement of plant temperatures by means of thermo-couples have been designed and are being tried out.

As regards the question of effective rainfall, it is found that the data collected at Pusa, Cawnpore, etc., are certainly interesting and merit careful study as suggested. Simultaneous measurements of evaporation from the soil surface as well as of the moisture retained by successive layers of the soil do not appear to have been recorded at these stations, and measurements at shorter intervals of depth with the portable gauges which have been designed at Poona are intended to supplement the earlier type of work. In particular it may be mentioned that with the large intervals of depth which have been used by earlier workers, it would be difficult to study the problem in detail either in short intervals of time or of depth.

Comparative observations of percolation through soils from different parts of India are also in progress.

A copy of the report (with a photograph of the Agricultural Meteorological Observatory) of the Agricultural Meteorology Branch which will appear shortly in the Administration Report of this department for the year ending March 1934, is enclosed



for information. The detailed annual report of the Branch will be forwarded in September, i.e., at the conclusion of the second year of its existence.

## ANNEXURE II.

### *Agricultural Meteorology Branch.*

This Branch which began to function during the previous year made progress in organising preliminary work at Poona on different aspects of the subject of Agricultural Meteorology.

The programme on the "experimental" side included a study of (1) the "micro-climate" within the first few feet above the ground in the open, (2) the "micro-climate" inside crops, (3) the "thermal balance" at the surface of the ground, (4) evaporation from soil and free water surfaces, (5) radiation from the sun, the sky and the earth's surface, (6) soil temperature in relation to soil colour and moisture at the surface and lower depths, (7) percolation of water through different depths of soil, (8) exchange of moisture between air and soil during clear weather, (9) meteorological factors in relation to incidence of frost during winter in India and (10) precision observations on the growth of wheat the micro-climate of that crop during the last Rabi season.

Most of these investigations were conducted at the Central Agricultural Meteorological Observatory situated in the farm of the Agricultural College, Poona. The installation of the various instruments was completed by December 1933 and a photograph of the observatory is seen on the opposite page. The results of some of the investigations referred to above are being discussed in a series of papers.

Attention was also paid to the design and construction of evaporimeters, percolation gauges, thermo-couple installations for the measurement of air, soil and plant temperatures, portable screens for the installation of thermometers inside crops and a few other instruments.

Experience was gained in methods of observation suited to a study of crop in relation to weather and a draft schedule on Crop-Weather precision observations was circulated to various agricultural workers for remarks and criticisms.

The Statistical Section of the Branch was mainly engaged in (1) a preliminary study of weather in relation to the cotton yields in the districts of the Bombay Presidency, (2) the analysis of data of some of the experimental farms in India, (3) the analysis of the "experimental" data collected at the Agricultural Meteorological Observatory at Poona, (4) the statistical analysis of meteorological factors for forecasting maximum temperature, (5) the calculation of evaporation in different months from other meteorological factors at about 100 representative stations in India and (6) the analysis of the precision observation on wheat. Some of the results have been discussed in a few papers which will be published shortly.

Besides the pioneer work undertaken at the Central Agricultural Meteorological Observatory at Poona, the co-operation of the Branch was freely extended to various Agricultural Departments or institutions by initiating work on similar lines. Advice regarding suitable meteorological instruments, standard methods of installing and taking observations from them was given to about 25 Agricultural Institutions or workers in India. Instruments received from four of the above were also standardised after minor repairs.

The Agricultural Meteorologist arranged with the Weather Section for the issue of frost warnings during last winter to the Nasik area where grapes are grown extensively. These warnings are reported to have been useful to the grape growers and much appreciated by them as they could take precautionary measures.

Mention may also be made of the co-operation extended to officers in charge of the Sugarcane and Dry Farming Schemes in Bombay, the Locust Research Scheme in Baluchistan, the Cereal Rust Scheme, and the Cotton Research Scheme at Coimbatore and Sakrand. To facilitate uniformity of work at different Agricultural Centres, it was decided to publish a suitable Agricultural Meteorology Hand-Book, a first draft of which was completed towards the end of the year.

The United Provinces Government deputed Mr. Sripal Singh and the Mysore Government Mr. Anantapadmanabha Rao for training in Agricultural Meteorology. Besides the above, numerous agricultural workers visited the observatory in order to see the equipment and method of observations; in all, about 320 visitors were shown round the observatory during the year.

Five Science Graduates are also carrying on research work under the guidance of the Agricultural Meteorologist.

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## APPENDIX XXVII.

REPORT OF SUB-COMMITTEE ON PLANT DISEASES, 20TH AND 21ST FEBRUARY 1935.

## PRESENT :

Mr. B. C. Burt, *Chairman*.  
 Mr. P. H. Carpenter,  
 Dr. T. Ekambaram,  
 Mr. L. D. Galloway,  
 Dr. V. N. Likhite,  
 Dr. K. McLean,  
 Dr. K. C. Mehta,  
 Dr. B. Narasimha Iyenger,  
 Mr. B. S. Patel,  
 Mr. Ramaswamy Pillai,  
 Mr. K. Ramiah.  
 Mr. J. H. Ritchie.

**SUBJECT 12** :—*Report on the deputation-abroad of Dr. B. N. Uppal, Plant Pathologist to the Government of Bombay, for the study of virus diseases of plants. (ii) Revival of Dr. Uppal's scheme of investigations into the virus diseases of plants originally sanctioned by the Council, with certain modifications introduced by Dr. Uppal as a result of his deputation abroad. (Appendix V).*

The Sub-Committee approved the deputation report of Dr. Uppal which was considered to be very satisfactory.

(ii) The Sub-Committee also approves the proposed re-distribution of the staff on the scheme the reasons for which are fully stated in the report, and recommends that the small additional grant involved be sanctioned.

2. At the time of filling the post of Assistant Pathologist consideration should be given to the need for qualifications in physiology and bacteriology and not solely in mycology.

The green-house now proposed is an essential item of equipment and the Sub-Committee recommends that this be provided and that the necessary additional grant of approximately Rs. 12,000 be sanctioned. The Sub-Committee would however observe that under Indian conditions cooling arrangements are likely to be absolutely essential and the experience gained at Agra suggests that these additions would cost about Rs. 1,400. On the other hand, it would seem to be both better and more economical to have the green-house completely constructed at Poona, importing from abroad only the essential material. In recommending the additional grant, the Sub-Committee has been guided by the fact that this is essentially an all-India investigation for a study of the technique of virus disease investigation rather than a study of particularly local diseases.

**SUBJECT 20** :—*Application from the Government of Travancore for a grant of Rs. 92,880 for a scheme for the investigation of the "root disease" of the coconut palm in South India. (Appendix VIII).*

The Sub-Committee considers that the first step in this research should be a thorough study of the question whether any causative organism is present. The question of whether a fungus disease is involved should therefore be cleared up by an intensive study and the possibility of this being a bacterial disease should not be overlooked. For this purpose a three year scheme is adequate. The Sub-Committee recommends that the Plant Pathologist to be appointed should have high research qualifications, experience of research in mycology and a good general knowledge of chemistry and bacteriology. The scale of salary proposed is suitable, provided that the initial salary may be up to Rs. 500 according to experience and qualifications. For the

Investigation proposed it will be sufficient to provide one routine Graduate Assistant on Rs. 75-5-85, one Laboratory Assistant on Rs. 25 and two peons. A much smaller allotment for travelling allowance, viz., Rs. 500 per annum will be sufficient and Rs. 500 will be sufficient for laboratory contingencies. The Travancore State has already undertaken to provide mycological laboratory accommodation and equipment and the necessary facilities and accommodation in coconut gardens, whilst their mycologist will help the new officer with experience and suggestions. The Sub-Committee also suggests that it should be clearly understood that the Travancore State will undertake to provide all necessary equipment for the carrying out of this scheme including microscopes. It also recommends that the Travancore State should provide all the labour required and any further laboratory contingencies. With these modifications the sub-committee recommends that the scheme be sanctioned. The problem is an important one throughout the coconut-growing areas.

**SUBJECT 24**—*Application from the Government of the Central Provinces for a grant of Rs. 35,500 for a scheme of research on pan cultivation. (Appendix XXVIII).*

The revised scheme now put forward is in accordance with the suggestions made at the last meeting of the Advisory Board and amounts to Rs. 19,500 in all spread over five years, of which Rs. 3,000 is non-recurring and Rs. 16,500 recurring, as compared to a total of Rs. 35,500 originally proposed. The revised scheme is approved, it being understood that all field experiments will be laid out so as to admit of statistical interpretation as usual in the Council's schemes. The Sub-committee carefully considered the question whether varietal or manurial trials would be possible during a five year scheme, in view of the fact that *pan* gives a full yield in the second year in the Central Provinces and that in the Ramtek area it is the practice to replant gardens after three years, it is satisfied that this can be done. As regards the staff, the sub-committee suggests that the Assistant Mycologist should be on the Central Provinces new scale for the class II provincial agricultural service, viz., Rs. 150—10—200.

**SUBJECT 25 (b)**—*Application from the Government of Bombay for a grant of Rs. 37,510 for a scheme for the investigation of the attack on tobacco by the Phanerogamic Parasite 'Orobanche'. (Appendix XXIX).*

The Director of Agriculture, Bombay, informed the sub-committee that in Gujerat this parasitic plant is more damaging to cigarette tobacco than to other tobaccos because the finer types are planted early and are irrigated. The sub-committee considered that there is some doubt as to whether the proposed programme of research work would lead to more satisfactory methods of dealing with this parasitic weed than those already in use. The plant is a comparatively large one so that its eradication by mechanical means is not very difficult. The sub-committee recommends that the scheme be postponed until the next meeting of the Advisory Board and that in the interim a further study of the literature on work carried out in other countries should be made by the authors of the scheme.

The Agricultural Expert undertook to write to the Imperial Bureau of Plant Genetics and to give any further assistance possible in regard to literature. It was also agreed that the Director of Agriculture should supply a memorandum giving all available data on the field experiments already carried out in the Bombay Presidency on the removal of this weed. It was further agreed that all Directors of Agriculture should be invited by the Council to send in a memorandum on methods of Orobanche control at present in use in various provinces.

**SUBJECT 25 (a)**—*Application from the Government of Bombay for a grant of Rs. 49,360 for a scheme for investigation into the attack on jowar by the parasite 'Striga' (Appendix XXX).*

This is a similar scheme to 25 (b). The parasite is perhaps somewhat less important but is more widespread. In the opinion of the sub-committee there should be a similar further study of the literature on 'Striga' and a circular letter should be issued

inviting Directors of Agriculture to supply any information available as to methods of control in use at present.

It is desirable that Professor Kumar, Acting Economic Botanist, Bombay Presidency should be invited to attend the next meeting of the sub-committee appointed to discuss these two schemes.

DELHI :

B. C. BURT.

*The 21st February 1935.*

## APPENDIX XXVIII.

NOTE, DATED THE 28TH DECEMBER 1934, BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT NO. 24 :—APPLICATION FROM THE GOVERNMENT OF THE CENTRAL PROVINCES FOR A GRANT OF RS. 35,500 SPREAD OVER A PERIOD OF FIVE YEARS FOR A SCHEME OF RESEARCH WORK ON PAN CULTIVATION.

At its meeting held in September 1934, the Advisory Board considered the attached application from the Government of the Central Provinces for a grant for a scheme of research work on pan cultivation (Annexures I—III). The Board also had before it a note by the Director of Agriculture, Central Provinces (Annexure IV) on the work carried out on diseases of pan in other provinces, especially Bengal and Bombay. The Board, however, recommended that the scheme should be returned for revision so that more precise details in regard to both the scientific and financial aspects might be furnished *vide* extracts from the proceedings of the Board at Annexure V.

The Director of Agriculture, Central Provinces, has now forwarded the attached revised and modified scheme (Annexure VI) involving an expenditure of Rs. 3,000 non-recurring and Rs. 6,500 per annum recurring or a total expenditure of Rs. 35,500 spread over a period of five years. The Vice-Chairman thinks that the receipts estimated in the scheme at Rs. 5,000 per annum are somewhat uncertain and that it would be reasonable to assume that the receipts will cover maintenance of gardens for which a sum of Rs. 3,200 per annum has been provided. On this basis the net cost of the scheme to the Council will be Rs. 3,300 per annum recurring or Rs. 16,500 spread over five years and a non-recurring expenditure of Rs. 3,000 or Rs. 19,500 in all.

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

## ANNEXURE I.

EXTRACT FROM LETTER NO. 48/1052-XIV, DATED THE 8TH JANUARY 1934, FROM THE REVENUE SECRETARY, GOVERNMENT OF THE CENTRAL PROVINCES, AGRICULTURE DEPARTMENT, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.

*Grant in aid from Imperial Council of Agricultural Research for certain schemes of research in the Central Provinces.*

I am directed by the Government of the Central Provinces (Ministry of Agriculture) to forward a copy of letter No. 5551, dated the 12th/13th December 1933, from the Director of Agriculture, Central Provinces, together with the undermentioned six schemes and to recommend them for the favourable consideration of the Imperial Council of Agricultural Research. The schemes are being printed and 150 copies of them will be furnished to you in due course.

\* \* \* \* \*

(6) Scheme for research on the Pan Cultivation (Annexure III).

2. These schemes have been considered by the Provincial Agricultural Research Committee on the 9th December 1933 and approved by that body. The local Government has also accepted them. I am accordingly, to request that they may be placed before the Advisory Board of the Imperial Council of Agricultural Research at its next meeting to be held in February 1934.

## ANNEXURE II.

COPY OF LETTER NO. 5551, DATED THE 12TH/15TH DECEMBER 1933, FROM THE OFFG. DIRECTOR OF AGRICULTURE, CENTRAL PROVINCES, TO THE SECRETARY TO GOVERNMENT, AGRICULTURE DEPARTMENT.

\* \* \* \* \*

I have the honour to attach herewith six schemes of research which were placed before the Provincial Agricultural Research Committee on the 9th December 1933 and

recommended for transmission to the Imperial Council of Agricultural Research for the provision of funds. The Provincial Agricultural Research Committee placed them in the following order of importance :—

- |  |      |
|--|------|
| Schemes for Research on the Orange Crop.         | } A. |
| Schemes for Research on the Oilseeds.            |      |
| Schemes for Research on the Potato Storage.      | } B. |
| Schemes for Research on the Gangai pest of Rice. |      |
| Schemes for Research on the Sann Hemp.           | } C. |
| Schemes for Research on the Pan cultivation.     |      |

\* \* \* \* \*

2. The cultivation of the Betel vine in India is not confined to one province only and the results acquired will be of value elsewhere. Pan growing is a specialized vocation but the money invested in the industry is very considerable and the losses from disease enormous. Controlled experiments in cultivation and treatment are essential if reliable results are to be gained. If this scheme is rejected by the Imperial Council of Agricultural Research, I wish to commend it to Government as a Provincial undertaking. It will be noticed that it is expected to be run at considerable profit and in addition to dealing with the several diseases of the plant, we shall acquire a large amount of information regarding the crop and its cultivation, about which we know very little at present.

### ANNEXURE III.

#### SCHEME ON PAN CULTIVATION.

This province produces or at least has produced in the past, a very large quantity of "pan" annually; but on account of the incidence of disease pan cultivation has completely been abandoned in many parts of the province, *e.g.*, Ramtek, Drug, Saugor. Since it is not only one disease that makes pan cultivation uneconomical in various parts of the province, remedial measures have to be tried for the control of diseases where they occur. A few attempts in the past have been made to study remedial measures for the control of these diseases, *e.g.*, in Ramtek it has been shown that foot-rot can be controlled by treating the soil systematically with Bordeaux Mixture; at Timarni there are two diseases, *viz.*, anthracnose and foot-rot, and they can be also controlled by the use of proper fungicides. At Piparia and Saugor our trials for the control of pan diseases were unsuccessful. The reason may be that there may have been more organisms than one infecting the crop and the remedy found effective for controlling foot-rot caused by *Phytophthora* was not useful against foot-rot caused by some other organism.

For the study of the causes of pan disease and for evolving suitable remedial measures a continuity of experiments for a period of years is essential; and this continuity cannot be ensured unless the department has pan gardens in different districts. A pan garden to give any reliable results must be not less than three-fourth of an acre at least and since the cost of starting a garden on this scale is rather prohibitive under our present financial conditions, I suggest that the Imperial Council of Agricultural Research be approached for a grant to start pan gardens in the following places, each garden to be of one acre :—

- (1) Richai (Adhartal).
- (2) Silari.

(The Deputy Director of Agriculture, Northern Circle, proposes to start two small gardens of the two places at the end of this cold weather.)

- (3) Saugor.
- (4) Nagpur.
- (5) Ramtek.
- (6) Bhanduk.
- (7) Drug or Raipur.
- (8) Badnera or any other suitable place in Berar.

The recurring and non-recurring expenditure will vary from place to place but approximately the non-recurring expenditure for a garden of one acre will be Rs. 800 for a period of four years and recurring expenditure will be approximately Rs. 800 per year. Therefore in four years the total expenditure will be Rs. 4,000.

If we have these gardens we cannot only investigate the pathological side of the problem but also agricultural. This latter problem can be studied by the Deputy Director of Agriculture in whose circle the garden is situated and his agricultural assistant in the district can look after the garden.

For the study of the pathological problem a special assistant under me will be required on Rs. 150 per month for four years with an annual increment of Rs. 25; he will need a travelling allowance of Rs. 300 a year and my travelling allowance grant will also need to be increased.

For the experiments an annual recurring grant of Rs. 1,000 will be required. The total expenditure for eight gardens for four years will be Rs. 46,200. A healthy garden normally shows a net profit of about Rs. 800 per acre annually. That is the eight gardens will bring a net profit of Rs. 6,400 per year. After meeting the extra cost for the pay of a special assistant his travelling allowance and agricultural experiments from this profit, a large surplus will be available.

J. F. DASTUR,  
Mycologist to Government  
Central Provinces,  
Nagpur.

## APPENDIX II.

EXTRACT FROM THE PROCEEDINGS OF THE ADVISORY BOARD MEETING HELD ON 19TH FEBRUARY 1934.

13. *Application from the Government of the Central Provinces for a grant of Rs. 46,200 spread over a period of 4 years for a scheme of research work on pan cultivation (Subject No. 12 of the Agenda).*

Mr. Ritchie introduced the scheme. Dr. Burns and Rao Bahadur Ananda Rao said that some work on *pan* cultivation and diseases had been done in Bombay and Madras respectively. Dr. McRae described the work done at the Pusa Research Institute on *pan* diseases in Bengal and Bihar and mentioned the three principal diseases which were prevalent in the monsoon, winter and summer respectively. He stressed the need for having a *pan* garden under the investigator's own control. Mr. Burt suggested that this subject be referred to a committee of the Advisory Board, the personnel to be selected by the Chairman as usual. This suggestion was approved and it was decided that the committee should meet before or on the occasion of the next Advisory Board meeting and should submit its report at that meeting. Meanwhile, information in regard to the work already done should be furnished to the Council's secretariat.

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## ANNEXURE IV.

NOTE BY THE DIRECTOR OF AGRICULTURE, CENTRAL PROVINCES.

A certain amount of work has been carried out on diseases of *pan* in other Provinces besides the Central Provinces, especially Bengal and Bombay.

In Bengal the chief problem has been the control of sclerotial diseases and in Bombay of the disease caused by *Phytophthora*.

In the Central Provinces *pan* is attacked by (1) two members of the *Phytophthoraceae*, (2) sclerotial fungi like *Rhizoctonia bataticola*, *R. Solani*; *Sclerotia Rolfsii*, etc., and (3) anthracnose caused by *Glocosporium sp.* *Colletotrichum sp.* and *Vermicularia sp.* Therefore the problems of the Central Provinces are more varied than



those of either Bengal or Bombay. Central Provinces were the first to show that *Phytophthora* could be controlled by treating the soil with Bordeaux Mixture and later Bombay confirmed our results. Even if in the Central Provinces there were no other disease of pan than that caused by *Phytophthora* still there would be a necessity for further study of this disease because what we now want to find out is what are the minimum strength of the fungicide, the minimum quantity and the minimum number of applications required. Another problem that requires to be investigated is which is the best method of irrigation and cultivation and which method influences most the incidence of disease. In these Provinces the methods of cultivation and irrigation vary considerably from place to place.

As regards the incidence of the many diseases of pan it is essential to know at what time of the year a particular disease caused most damage and if climatic conditions influence its incidence.

In these Provinces the varieties of pan chiefly cultivated are Bangla and Kapoori; other varieties, such as Gangeri, are also cultivated but not to the same extent as the former two. Therefore another problem that would be investigated is the problem of finding out suitable resistant varieties.

Thus even though some work has been done in other Provinces and in this Province, still much work requires to be done and the further work that we propose to do is in no sense "duplication of work already done".

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#### ANNEXURE V.

EXTRACT FROM THE PROCEEDINGS OF THE ADVISORY BOARD MEETING HELD IN SEPTEMBER 1934.

\* \* \* \* \*

16. *Application from the Government of the Central Provinces for a grant of Rs. 46,200 spread over a period of four years for a scheme of research work on pan cultivation (Subject No. 58 of the Agenda).*

Mr. Ritchie, in introducing the scheme, said that for the study of the causes of pan disease and for evolving suitable remedial measures continuity of experiments for a period of years was essential and that this continuity could not be ensured unless the department had pan gardens of its own in different districts. It was proposed to do the work in eight places, and it was hoped that there would be a net profit of Rs. 6,400 per year. The scheme therefore was a profitable one and should be sanctioned. Dr. Burns had every sympathy with the scheme but he could not see what Dr. Dastur was going to do in the eight gardens proposed by him. The scheme itself was not clear inasmuch as it was difficult to find out exactly what each item would cost. He was therefore not prepared to support the scheme in its present form. Dr. Shaw agreed with Dr. Burns that they had no details as to the precise investigations to be carried out on pan disease. The Chairman summed up the discussion and proposed that the scheme be returned to the Central Provinces Government for revision so as to give more precise details in regard to both the scientific and financial aspects. The Board agreed.

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#### ANNEXURE VI.

##### SCHEME ON PAN CULTIVATION.

Pan (Piper betel) is grown all over India and although the total acreage may not be very large, the value of the crop is sufficiently great to justify a study of its cultivation and pathology. As far as I am aware, no Department of Agriculture has studied this important crop and as far as the Central Provinces is concerned, it was only when some District authorities appealed to the Department to stay the ravages of disease, which was wiping out gardens in various parts of the Province, that the Department started to interest in this plant.

Pan growers have formed themselves into a sort of trade union with closely guarded secrets and officers of the Department have found the greatest difficulty even in being allowed to visit their gardens besides enlisting their co-operation for the study and treatment of diseased vines. Very little is known about the cultivation and the varieties of pan and if a proper study is to be made, it is very necessary that the Department should have gardens of its own and it is to provide for these that this Scheme is submitted.

In a scheme previously submitted, it was intended to have 8 small gardens in different parts of the Provinces where the methods of cultivation, irrigation, etc., common to the tract would be tried out. In the present scheme, it was considered advisable to concentrate the work in one place and to make provision for visits to outside gardens to carry out experiments on diseases or any other aspect of the problem which it would be inexpedient or impossible to carry out in the central garden. The scheme differs from the previous one only in this respect.

The Scheme consists in a study of the different varieties of Pan, its cultivation, irrigation, manuring, diseases, pests, etc. In the Central Provinces, 2 main varieties are grown, though there are 2 or 3 others. It is intended to make a collection of all the principal varieties grown in the different Provinces of India and carry out a varietal test. The present methods of cultivation in the Province are being studied and these will be tried out and the best one used or a better one devised. The manuring of this plant seems to be more a religious rite than a desire to supply those elements on which the health and growth of the vine depend. Manurial experiments are very necessary therefore. Several diseases are known to attack Pan and remedial measures have proved successful in certain cases. In other cases, control has proved unsuccessful. It is therefore necessary that all the diseases which are known to attack Pan should be studied and control measures devised.

The details of the experiments to be carried out will be furnished for the approval of the Imperial Council of Agricultural Research before the scheme commences.

To carry out all the work detailed above a garden, 4 acres in extent, will be necessary. I estimate the following expenditure as being necessary for starting and maintaining a garden of this size. The Scheme will last for 5 years.

<i>Non-recurring.</i>	}	<i>Rs. 3,000.</i>	<i>Recurring (Annual).</i>	}	<i>Rs. 3,200.</i>
Cost of cuttings.	}	Rs. 3,000.	Manure.	}	Rs. 3,200.
Preparation of chick house.			Permanent labour.		
Rent of land.			Variable labour.		
One pair of bullocks.			Feeding charges.		
	Repairs to chick house, etc.				

For the study of the pathological problems, a special assistant will be required on Rs. 150 per mensem with an annual increment of Rs. 25 Average Rs. 2,400. Any help he will require for laying out the garden, etc., will be provided by the local agricultural staff. Travelling allowance at Rs. 300 per annum will also be required.

Summarized, the annual cost will therefore be :-

	Rs.
Maintenance of garden . . . . .	3,200
Mycological Assistant . . . . .	2,400
Travelling Allowance . . . . .	300
Contingencies (Experiments, fungicides, etc.) . . . . .	600
	6,500

The income from the garden is expected to average Rs. 5,000 per year which will be credited to the Imperial Council of Agricultural Research.

J. RITCHIE,  
*Director of Agriculture, C. P.*

## APPENDIX XXIX.

NOTE, DATED THE 23RD JANUARY 1935, BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT No. 25 (b).—APPLICATION FROM THE GOVERNMENT OF BOMBAY, FOR A GRANT OF RS. 37,510 SPREAD OVER FIVE YEARS FOR A SCHEME FOR THE INVESTIGATION OF THE ATTACK ON TOBACCO BY THE PHANEROGAMIC PARASITE "OROBANCHE".

Attention is invited to the attached extracts (Annexure I) from a letter No. 2872-A./33, dated the 12th November 1934, from the Government of Bombay, forwarding the application (Annexure II) mentioned above. The scheme involves, so far as the Council is concerned, non-recurring expenditure of Rs. 5,500 and recurring expenditure of Rs. 32,010 or a total expenditure of Rs. 37,510 spread over five years.

2. The Vice-Chairman considers that it would be of advantage to have the scheme examined first by a Sub-Committee consisting of :—

1. Sir T. Vijayaraghavacharya, Vice-Chairman, Imperial Council of Agricultural Research. Chairman (*Ex-officio*.)
2. The Agricultural Expert, Imperial Council of Agricultural Research.
3. The Director of Agriculture, Bombay.
4. The Director of Agriculture, Central Provinces.
5. The Mycologist, Imperial Institute of Agricultural Research (subject to the approval of the Government of India).
6. Professor T. Ekambaram.
7. Dr. K. C. Mehta (subject to the approval of the Principal, Agra College). Secretary, Imperial Council of Agricultural Research, Secretary (*Ex-Officio*).

This Committee will meet on an afternoon between the 18th and 23rd February 1935, and its report will be submitted to the Advisory Board in due course.

3. The Advisory Board is specially requested to consider the following two questions in this connection :—

(i) In para. 3 of their letter (Annexure I) the Local Government have stated they will not be prepared to undertake any financial liability on account of the scheme. This seems to offend principle (vi) of the principles governing grants by the Council, laid down by the Governing Body, *viz.* :—

"That ordinarily the Government or Governments interested in a scheme should bear part of the recurring expenditure, the exact proportion to depend on negotiation between the Council and the Government, or Governments concerned".

(ii) The Bombay Government have submitted a scheme for investigation into the attack on Jowar by the parasite 'Striga', which is being placed before the Advisory Board separately [item No. 25 (a) of the agenda]. It is for consideration whether these two schemes should not be combined.

## ANNEXURE I.

EXTRACT FROM LETTER No. 2872-A./33, DATED THE 12TH NOVEMBER 1934, FROM THE SECRETARY TO THE GOVERNMENT OF BOMBAY, REVENUE DEPARTMENT, BOMBAY CASTLE.

I am directed by the Government of Bombay (Transferred Departments) to forward the following five schemes for grants-in-aid from the funds of the Imperial Council of Agricultural Research.

- \* \* \*
- (3) Scheme for the investigation of the attack on tobacco by the Phanerogamic Parasite "Orobanche" by Mr. B. S. Patel, Deputy Director of Agriculture, Gujarat. (Annexure II.)
- \* \* \*

I am to state that the first four schemes were approved by the Provincial Agricultural Research Committee at a meeting held on 20th July 1934. The Government

of Bombay recommend these schemes for the favourable consideration of the Imperial Council of Agricultural Research.

3. I am to add that the Government of Bombay will not be prepared to undertake any financial liability on account of the cost of any of the five schemes mentioned above.

#### ANNEXURE II.

A SCHEME FOR THE INVESTIGATION OF THE ATTACK ON TOBACCO BY THE PHANEROGAMIC PARASITE "OROBANCHE" TO BE CONDUCTED AT NADIAD (GUJARAT) BY B. S. PATEL, I.A.S., N.D.A., N.D.D., DEPUTY DIRECTOR OF AGRICULTURE, GUJARAT, IN COLLABORATION WITH PROFESSOR L. S. S. KUMAR, M.Sc. (LOND.), A.R.C.S., D.I.C., ACTING ECONOMIC BOTANIST TO GOVERNMENT, BOMBAY PRESIDENCY, POONA.

Tobacco (*Nicotiana tabacum*) is a very important economic crop grown in all the provinces of India and Burma. The total area under tobacco in India including Burma is well over a million acres and of which more than one hundred and twenty thousand acres are alone in the Bombay Presidency. Tobacco is grown not only for internal consumption but also as a commodity for export on a large scale. The importance of this crop has become enhanced as the source of revenue to Government ever since the imposition of excise duty on tobacco. In future years tobacco is likely to become a source of steady and large revenue to Central and Provincial Governments since duty on tobacco had already been earmarked as a source of revenue for the Federal Government when it would be established. Besides the enhancement of duty on foreign tobacco and cigarettes has given a fillip to a larger cultivation of this crop and the increased manufacture of Indian cigarettes. The profits from tobacco cultivation does not accrue only to the Governments but also to the cultivator, to many of whom it is a source of living, and to the trader and salesmen who deal in tobacco or its byproducts. *In view of the importance of this crop any disease or parasite attacking tobacco should be seriously considered and every means should be taken to combat it.*

#### OROBANCHE ON TOBACCO.

Among the many pests attacking tobacco perhaps none causes greater damage in this country than the phanerogamic (flowering plant) parasite *Orobanche*. There are three species of *Orobanche* viz. *O. cernua*, *O. nicotianae*, and *O. indica*, all of which attack tobacco but the former two being responsible for the greatest damage. Although well over a million acres are under tobacco in this country, the yield from this would have been considerably more than at present had it not been for the attack by this pest. Without extending the area under tobacco the yield could be considerably increased if some measures were found out to combat the attack by *Orobanche*.

The appearance of the parasite has been reported from Burma, Bihar and Orissa, North-West Frontier Province, Bombay Presidency and Central Provinces.

#### PREVIOUS WORK ON OROBANCHE.

*Orobanche* has been the subject of study for over a century in Europe and elsewhere and much of the work has been of a classificatory type. Besides the works of Hooker and Prain on classification of *Orobanche* in India, very little of any value has been done to combat this pest. Shaw (1917)\* in his experiments on using chilli saltpetre (sodium nitrate) as a measure of checking the attack has definitely shown that sodium nitrate in no way minimised the attack. So far no one has attempted any work either from physiological or genetic point of view, viz., to ascertain the effect of the parasite on the host or evolving resistant types of tobacco.

The seriousness of the problem could be gauged from the fact that the severity of attack in Pusa was such as to make tobacco cultivation on a large scale out of the question. In the Bombay Presidency, particularly in Gujarat where most of the tobacco is grown, the complaint against this pest is increasing year by year. The pest has become such a source of danger to tobacco cultivation that the good yield from this

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\**Orobanche* as a parasite in Bihar. Memoirs of the Department of Agriculture in India, Volume IX, No. 3, August 1917, Botanical Series.

crop is being threatened more and more every year. This is a problem that requires immediate consideration and hence this scheme has been put up as it is also of all-India importance.

An exhaustive scheme extending over a period of five years along with cost is detailed below. In the proposed scheme all the three species of *Orobanche* will come under study along with the principal types of tobacco grown in different provinces. The points for investigation as proposed to be taken up under this scheme are :—

#### I. Physiological—

- (a) Study of the factors influencing the germination of the parasite seeds, viz., the maximum, optimum and minimum temperature and moisture for germination.
- (b) The nature of the soil that induces the severest attack, viz., acidity or alkalinity moisture, nitrogen, content, etc.
- (c) Qualitative and quantitative difference in the end products between healthy and attacked plants.
- (d) The nature of the food material and method of its absorption by the parasite.

#### II. Histological—

- (a) Study of the formation of haustoria and its connection with the host root.

#### III. Agronomical—

- (a) Estimate the loss in yield and quality of tobacco as a result of attack by the parasite by field observation.
- (b) Observations on seasonal effect on the host and the parasite.
- (c) Surveying and obtaining information as to the exact incidence of the pest in the tract.
- (d) Study of the methods of control in the field—
  - (i) By rotation of suitable crops.
  - (ii) Destruction of parasite by uprooting it when it is fully grown.
  - (iii) Study of infection through seed bed and the use of parasite as cattle feed.

#### IV. Genetic—

- (a) Try methods to evolve homozygous resistant types of tobacco for the tract
- (b) Study of the inheritance of resistant character.

The above is only an outline of the proposed investigation and many problems which will suggest themselves as the work will be taken on hand will need to be worked out.

#### EXPENDITURE.

In view of the financial stringency prevailing in this country and the limited sum available with the Imperial Council of Agricultural Research, the salaries of the staff for the above scheme have been based on the newly introduced scales of pay by Bombay Government.

The proposed staff includes—

	Rs.
(1) Investigator . . . . .	160—10—260.
(2) Assistant Investigator (service to commence from the second year of the scheme) . . . . .	70—5—100.
(3) Fieldman . . . . .	35—5/2—60—4—100.
(4) Peon . . . . .	15 per mensem.

#### NON-RECURRING EXPENDITURE.

The sum under this head will be used for equipping a small laboratory at Nadiad to carry on physiological, histomorphological and genetic work. The cost will include purchase of a good microscope, glass apparatus and chemicals for physiological work,

paraffin embedding oven, camera lucida for histological work, apparatus for preparing distilled water, apparatus for determining pH values of soils and cell sap, indicators, incubators, equipment by way of laboratory tables, chemical shelves and such other requirements of a laboratory.

#### RECURRING EXPENDITURE.

*Travelling allowance.*—This is required for the Investigator and Assistant Investigator for travelling in the district to gather information and study the extent of damage caused by *Orobancha* and to travel to Poona to consult the Headquarter Expert (Economic Botanist).

#### CHEMICALS AND APPARATUS.

The recurring expenditure on this item has been put down at its minimum and will include the purchase of alcohol stains, reagents, chemicals, etc. To economise in this item would be detrimental to the work.

#### MISCELLANEOUS.

This item includes rent, land, cost of cultivation, daily labour, purchase of seeds and manures, stationery, office expenses, postage, etc. The lowest figure possible has been given.

#### RESERVE.

This is an item to meet unforeseen expenditure which cannot be thought of beforehand. Any saving accrued in this item will lapse to the Imperial Council of Agricultural Research as in all other items.

*Statement showing the Recurring and Non recurring expenditure on the scheme for the Investigation of the Attack on Tobacco by the "Orobancha."*

No.	Detailed head of expenditure.	Amount for every year in rupees.					Total amount.
		1st year.	2nd year.	3rd year.	4th year.	5th year.	
	<i>Non-recurring Expenditure.</i>						
1	Equipment of laboratory for physiological, histological & genetic work.	5,000	..	..	..	..	5,000
2	Purchase of furniture.	500	..	..	..	..	500
	Total	5,500	..	..	..	..	5,500
	<i>Recurring Expenditure.</i>						
3	Investigator on Rs. 160—10—260.	1,920	2,040	2,160	2,280	2,400	
4	Assistant Investigator on Rs. 70—5—100 (from second year).	..	840	900	960	1,020	
5	Fieldman on Rs. 35—5/2—60—4—100.	420	420	480	480	540	

No.	Detailed head of expenditure.	Amount for every year in rupees.					Total amount.
		1st year.	2nd year.	3rd year.	4th year.	5th year.	
6	Peon on Rs. 15 per month.	180	180	180	180	180	
7	Travelling allowance for Investigator and Assistant Investigator.	500	500	500	500	500	
8	Apparatus and chemicals.	500	500	500	500	500	
9	Miscellaneous including rent of land, cultivation, cost of daily labour, stationery, postage etc.	750	750	750	750	750	
10	Reserve	500	500	500	500	500	
11	Rent of office and laboratory accommodation.	600	600	600	600	600	
	Total	5,370	6,330	6,570	6,750	6,990	32,010
	GRAND TOTAL	..	..	..	..	..	37,510

## APPENDIX XXX.

NOTE, DATED THE 26TH JANUARY 1935, BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT No. 25 (a).—APPLICATION FROM THE GOVERNMENT OF BOMBAY FOR A GRANT OF Rs. 49,360 SPREAD OVER FIVE YEARS FOR A SCHEME FOR INVESTIGATION INTO THE ATTACK ON JOWAR BY THE PARASITE STRIGA BY THE ECONOMIC BOTANIST TO THE GOVERNMENT OF BOMBAY.

Attention is invited to the attached extracts from a letter No. 2872-A./33, dated the 12th November 1934, from the Government of Bombay, forwarding the application mentioned above (Annexure I). The scheme (Annexure II) involves, as far as the Council is concerned, recurring expenditure of Rs. 40,360 and non-recurring expenditure of Rs. 9,000 or, a total expenditure of Rs. 49,360 spread over five years.

2. The subject is for the consideration of the Advisory Board. It will be noted that the scheme does not appear to satisfy principle (vi) of the principles governing grants made by the Council which have been laid down by the Governing Body, viz. :—

“That ordinarily the Government or Governments interested in a scheme should bear a part of the recurring expenditure, the exact proportion to depend on negotiation between the Council and the Government or Governments concerned.”

## ANNEXURE I.

EXTRACT FROM LETTER No. 2872-A./33, DATED THE 12TH NOVEMBER 1934, FROM THE SECRETARY TO THE GOVERNMENT OF BOMBAY, REVENUE DEPARTMENT, BOMBAY.

I am directed by the Government of Bombay (Transferred Departments) to forward the following five schemes for grants-in-aid from the funds of the Imperial Council of Agricultural Research.

(2) Scheme for investigation into the attack on Jowar by the parasite *striga* conducted by Mr. L. S. S. Kumar, Acting Economic Botanist.

I am to state that the first four schemes were approved by the Provincial Agricultural Research Committee at a meeting held on 20th July 1934. The Government of Bombay recommend these schemes for the favourable consideration of the Imperial Council of Agricultural Research.

3. I am to add that the Government of Bombay will not be prepared to undertake any financial liability on account of the cost of any of the five schemes mentioned above.

## ANNEXURE II.

A SCHEME FOR INVESTIGATION INTO THE ATTACK ON JOWAR BY THE PARASITE STRIGA TO BE CONDUCTED AT POONA BY PROF. L. S. S. KUMAR, M.Sc. (LOND.), A.R.C.S., D.I.C., ACTING ECONOMIC BOTANIST TO GOVERNMENT OF BOMBAY, POONA.

The genus *Striga* belongs to the Natural Order Scrophulariaceae, which includes a number of phanerogamic parasites. There are four species of *Striga* in India, three of which are hemi-parasites causing serious damage to Jowar crop in many of the provinces of this country. The parasite is a flowering plant producing a large number of minute seeds which are easily distributed by the wind. Once the parasite infests a particular area its eradication is almost impossible by the means at the disposal of cultivators.



*Striga* is not only a destructive pest on Jowar but also attacks other economic crops such as sugarcane, finger millet (*Elusine coracana*) and Kodra or Italian hill millet (*Paspalum scrobiculatum*). Besides it has a fairly wide range of hosts in uncultivated plants and grasses.

The problem of "witch weed" (*Striga*) has become so serious in South Africa and Australia that for many years intensive measures have been taken for its eradication and yet the control has not been very successful. Catch crops trap crops, uprooting, repeated ploughing and various other methods have been tried with but little success. In India this problem is equally serious and practically beyond reporting the occurrence of the parasite and one or two remedial measures of uneconomical nature, nothing has been done to combat the serious loss to one of the staple crops of this country from attack by this parasite.

The area under Jowar in India is 20,616,072 acres of which Bombay Presidency grows 8,315,203\* acres or 40.3 per cent. of the total crop. There are a large number of varieties of Jowars suited to the different tracts in India and *Striga* has so far been seen to attack all of them. In the Bombay Presidency itself *Striga* occurs in the Karnatak, the Deccan and Gujarat tracts which differ considerably from each other in climatic and soil characters. There are tracts in the Bombay Presidency where Jowar cannot be grown due to heavy infestation by *Striga*. *Striga* occurs on Jowars in the Central Provinces, Madras Presidency, Hyderabad State and Mysore Province. The attack of *Striga* on Jowar is a problem affecting more than half the number of provinces in India and calls for immediate investigation into and for devising methods of over-coming the loss to cultivators in yield. In the Bombay Presidency year by year the *Striga* infested area is increasing and the cultivators finding the task of eradication hopeless have resigned themselves to such a state as to gather whatever yield the parasite will allow after it has done its damage.

The proposer of this scheme has been doing work on this parasite for the last two years and finds that to tackle the problem in all its entirety needs a bigger organisation and more grants. Otherwise the work will take years before it will be completed. In order to facilitate early investigation of the problems on hand and in view of its all-India importance the Imperial Council of Agricultural Research is being approached for sufficient funds to carry out the work.

Little emphasis need be laid on the importance of the Jowar crop. In most of the tracts where Jowar is grown on a large scale the grain forms the staple food of the great majority of the agricultural classes and the stalk, an excellent fodder for cattle. This is a crop of tracts of low rainfall and as such is a necessity to cultivators where no other foodstuff will grow. Since *Striga* causes serious damage to Jowar, a poor man's crop, the necessity for this investigation is all the more important.

The investigation will include experiments of physiological, histological, agronomical, cytological and breeding nature. The outline of the problem is as follows:—

#### I. Physiological:—

- (1) Factors influencing the germination of parasites seed.
- (2) The capacity for resistance to adverse circumstances by the seed of the parasite.
- (3) The nature of the food material absorbed and method of its absorption by the parasite.
- (4) The difference in the end products manufactured between the host and the parasite. Presence of HCN in *Striga* attacking Jowars, etc.
- (5) The difference between the four species of *Striga* with respect to (i) power of germination and stimulus required for seed germination and (ii) power to attack same or different host varieties.
- (6) The relation of soil to incidence of attack by the parasite.

#### II. Agronomical:—

- (1) Climatic factors influencing the attack.
- (2) Survey of the area infested and estimation of loss.
- (3) Determination of the loss in yield by pot culture and field experiments.

#### III. Histological:—

- (1) The method of formation of haustoria and its connection with the host root.

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\*The figures given are for area under Jowar in 1925-26.

IV. *Cytological* :—

The difference in number and characteristics of the chromosome between the four species.

V. *Breeding* :—

- (a) Difference in virulence of attack of different species of *Striga*.
- (b) Degree of susceptibility to attack by different varieties of Jowars
- (c) Selection of homozygous resistant varieties of Jowar as suited to different tracts.
- (d) Study of the inheritance of resistant character.

The above gives a bare outline of the experiments to be conducted, with additions being made as and when the problems will suggest themselves during the course of the investigation.

## EXPENDITURE.

In order that the scheme may be acceptable to the Imperial Council of Agricultural Research, every item has been carefully thought over and the minimum sum required which is consistent with the importance of the investigation to be taken on hand has been put down.

The scheme as proposed is for five years so as to allow time to complete all the problems outlined in the programme given above. The scheme will be located in Poona with three sub-stations—one in the Karnatak, one in the Deccan and one in Gujarat for field trial experiments. There is already a certain amount of laboratory facilities available in Poona, and therefore a sum to purchase only additional equipment is included as non-recurring grant.

In order to evolve homozygous resistant types of Jowars, it would be necessary to subject the plants to optimum conditions conducive to severest attack. To do this artificially infected pots with controlled temperature and moisture will have to be used and therefore the equipment of soil temperature tanks has been included in the non-recurring expenditure. The cost of a shed, electric installation, soil temperature tanks, etc., has been included under this item.

The travelling allowance is meant for the Investigator and Assistant Investigator to travel to the three sub-stations periodically for inspection and also for the fieldmen to go into their respective districts and report on the extent of incidence of attack.

The miscellaneous item will include rent of land, cost of daily labour, cost of cultivation, stationery, postage, etc.

The Reserve is meant for unforeseen expenditure which cannot be anticipated and for which the sum cannot be asked once the scheme is sanctioned. Any balance accruing from any of the items will lapse to the Council.

The staff for the proposed scheme is as under :—

- (1) One Investigator on Rs. 160—10—260.
- (2) One Assistant Investigator on Rs. 70—5—100.
- (3) Four Fieldmen on Rs. 35—5/2—60—4—100 each.
- (4) One Laboratory Boy on Rs. 20—1—25.
- (5) One Peon on Rs. 18 per mensem.

A statement giving the detailed cost for five years of the entire scheme is attached.

(Signed) L. S. S. KUMAR,  
Acting Economic Botanist to Government,  
Bombay.

*Statement showing the recurring and non-recurring expenditure on the scheme for the investigation into the attack on Jowar by the parasite Striga to be carried out at Poona under the control of Acting Economic Botanist.*

No.	Detailed head of expenditure.	Amount for every year in rupees.					Total amount.	Remarks.
		1st year.	2nd year.	3rd year.	4th year.	5th year.		
	<i>Non-recurring expenditure.</i>						Rs.	
1	Purchase of apparatus not available with the existing equipment at Poona.	3,500	..	..	..	..	3,500	
2	Purchase of soil temperature tank, electric installation, and shed for the tank.	5,000	..	..	..	..	5,000	
3	Purchase of furniture . . . . .	500	..	..	..	..	500	
	Total . . . . .	9,000	..	..	..	..	9,000	
	<i>Recurring expenditure.</i>							
4	Investigator on Rs. 160—10—260 . . . . .	1,920	2,040	2,160	2,280	2,400	..	
5	Assistant Investigator on Rs. 70—5—100 . . . . .	840	900	960	1,020	1,080	..	
6	Four Fieldmen on Rs. 35—5/2—60—4—100 each.	1,680	1,680	1,920	1,920	2,160	..	
7	Laboratory Boy on Rs. 20—1—25 . . . . .	240	252	264	276	288	..	

8	Peon on Rs. 18 per mensem . . . . .	216	216	216	216	216	..
9	Travelling allowance for Investigator and Assistants.	1,000	1,000	1,000	1,000	1,000	..
10	Apparatus and Chemicals . . . . .	500	500	500	500	500	..
11	Miscellaneous . . . . .	600	600	600	600	600	..
12	Reserve . . . . .	500	500	500	500	500	..
		7,496	7,688	8,120	8,312	8,744	40,360
		Grand total					49,360

## APPENDIX XXXI.

## PROCEEDINGS OF THE THIRD MEETING OF THE CATTLE BREEDING COMMITTEE OF THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH HELD AT DELHI ON THE 18TH AND 19TH FEBRUARY 1935.

The following were present :—

1. Diwan Bahadur Sir T. VIJAYARAGHAVACHARYA, *Chairman.*
2. Col. A. OLVER.
3. Mr. T. F. QUIRKE.
4. Mr. E. J. BRUEN.
5. Khan Sahib DOST MOHD. KHAN.
6. Mr. C. H. PARR.
7. Mr. F. WARE.
8. Mr. T. J. EGAN.
9. Mr. B. K. BADAMI.
10. Mr. S. V. RAMAMURTY.

Rai Bahadur Malik Charan Das, *Secretary.*

2. The meeting lasted from 3-30 P.M. to 6 P.M. on the 18th and from 10-30 A.M. to 12-15 P.M. on the 19th.

3. *Application from the Government of Bombay for a grant of Rs. 1,22,310 spread over a period of ten years for research in goat breeding in the Bombay Presidency.* (Subject No. 15 of the Agenda) (Appendix XXXII).

In the course of discussion it was agreed that experimental goat breeding was likely to be of considerable benefit in relation to village uplift work which is now being developed all over India and that it was desirable that research should be carried out on the development of Surti and Gujrati goats, as part of a comprehensive scheme which is being developed for goat breeding in this country. It was also agreed that one of the advantages of this scheme was that the work would be carried out at three centres in different regions of the Province, two of which were Mission centres. This arrangement would allow scope for selection and should avoid the necessity for purchasing fresh stock from outside sources as the work proceeded. It was agreed that the Head Flockman for the Poona establishment should be deleted and that the number of flockmen should be reduced from 5 to 4 at Poona and from 3 to 2 each at Vadala and Ankleswar. It was also considered that the feeding charges should be reduced at Poona from Rs. 3,060 to Rs. 2,000 and at Vadala and Ankleswar from Rs. 1,530 to Rs. 1,000 each. With these modifications it was decided that the scheme should be recommended to the Board as it stood.

4. *Application from Mr. J. J. De Valois of the Agricultural Institute, Katpadi, for a scheme of research on goat breeding at a cost not exceeding Rs. 84,172 (Rs. 5,480 non-recurring and Rs. 78,692 recurring) spread over a period of ten years.* (Subject 38 of the Agenda) (Appendix XXXIII).

After discussion it was agreed that the scheme should be recommended to the board for approval as it stood. In the course of discussion Mr. Ware, however, pointed out that the information which had been given to the Committee that no well-defined breed of goat existed in Madras was incorrect and that the Malabar Goat was a valuable goat well worth systematic development. Mr. Ramamurty pointed out that work on the Malabar goat was included in the scheme as originally presented and that it formed a very small fraction of the total number of goats available in Madras besides its being confined to a small portion of Madras. It was therefore agreed that special attention should be paid to the Malabar goat in regard to selection breeding and that cross breeding of Jumna Paris and Surtis should be employed mainly as a means of improving the nondescript goats of inferior quality which existed in other areas.

5. *Application from the Government of Bombay for a scheme of research in poultry husbandry to be conducted in the Bombay Presidency at a cost not exceeding Rs. 61,053 (Rs. 22,023 non-recurring and Rs. 39,030 recurring) spread over a period of three years.* (Subject No. 16 of the Agenda) (Appendix XXXIV).

The Committee considered that this was a valuable scheme likely to be of considerable benefit in relation to village uplift work. It was suggested however in the course

of discussion that more importance should be attached to the development of existing Indian breeds than to the introduction of foreign breeds which was already being dealt with at other centres. It was considered that the amount provided for housing and runs at the Government Central Poultry Farm, Kirkee, should be reduced from Rs. 5,500 to Rs. 4,000 and that the amounts for housing, runs, etc., at Vadala and Ankleswar should be reduced in each case from Rs. 3,600 to Rs. 2,000. It was also decided that the item of additional pay to the Manager at the Central Poultry Farm, Kirkee, should be deleted and that the designation "Village Research and Investigation Officer" should be changed to "Village Investigation Officer" in the schemes for work at Vadala and Ankleswar. With these modifications the scheme was recommended to the Board for approval.

6. *Application from the United Provinces Poultry Association for a grant for research into the preservation and handling of eggs and poultry prior to their disposal in the market at a cost not exceeding Rs. 32,570 (Rs. 5,784 non-recurring and Rs. 26,786 recurring) spread over a period of three years.* (Subject No. 40 of the Agenda) (Appendix XXXV).

It was agreed that the work proposed in this scheme was very important for the development of a poultry industry in India and it was suggested in the course of discussion that the scheme should be placed high up in the list for provision of funds. In discussing the work to be done it was agreed that it should be clearly laid down that the whole scheme would be carried out under the general supervision of the Director of Veterinary Services, United Provinces, and that items (a), (b), (c) and (d) of the investigations proposed would be carried out under the control of the Secretary, United Provinces Poultry Association, while item (e) would be carried out at the Harcourt Butler Technological Institute. The question of using broody hens to hatch eggs was considered and it was decided that it would be desirable that the incubation of eggs should be done only in incubators, of which it was understood that several were available at the United Provinces Poultry Association in addition to the one which it is proposed to purchase for work under this scheme. As regards non-recurring expenditure of the work it was decided that the price of cockerels, hens and laying pullets should be reduced to Rs. 10 each and that it would be desirable that a statement should be included in the scheme showing precisely what would be provided by the United Provinces Government and the United Provinces Poultry Association. It was also decided that an estimate should be given of the returns to be expected from the scheme.

Under recurring expenditure it was decided that the designation "Farm Manager" should be substituted for "Egg Experimental Officer" and that his rate of pay should be reduced to Rs. 120—10—140. It was also considered that the waterman should be deleted and the number of poultrymen increased to 3 at Rs. 12 per mensem each as they have to be experienced poultrymen. It was also decided that the word "Contingencies" should be deleted and Rs. 150 a year provided for stamps and stationery and that Rs. 200 a year should cover miscellaneous expenditure including Books and Periodicals. It was further considered that travelling allowance should be reduced to Rs. 200 a year and that the words "(containers and other packing material)" should be deleted after "Materials for experimental purposes". With these modifications the scheme was recommended for the approval of the Board.

DELHI,

A. OLVER,

The 20th February 1935.

## APPENDIX XXXII.

NOTE, DATED THE 30TH JANUARY 1935, BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT NO. 15.—APPLICATION FROM THE GOVERNMENT OF BOMBAY FOR A GRANT OF RS. 1,22,310 SPREAD OVER A PERIOD OF TEN YEARS FOR RESEARCH IN GOAT BREEDING IN THE BOMBAY PRESIDENCY.

Attention is invited to the letter from the Government of Bombay, No. 782-A./33, dated the 17th December, 1934 (Annexure I) forwarding a scheme for research in Goat Breeding (Annexure II). The scheme is estimated to cost Rs. 1,29,410 (Rs. 11,060 non-recurring and Rs. 1,11,250 recurring) spread over a period of ten years. Against this cost there is an estimated income of Rs. 45,600 during the progress of the Scheme. At the conclusion of the scheme property estimated at Rs. 9,970 consisting of livestock and building will be left on the farm. The Bombay Government have agreed to provide Rs. 7,100 for non-recurring expenditure. The total expenditure on account of this scheme payable by the Council will be Rs. 66,740. The local Government will provide the necessary land and the Livestock Expert and his staff will supervise the scheme.

2. As the members are aware the Bombay Government submitted a similar scheme in June 1933. This was considered firstly by an *ad hoc* Committee which reported that the scheme required modification but it was for the Advisory Board to decide whether they should finance the scheme in view of the fact that the Bombay Government were not prepared to finance any part of the capital cost. The Board recommended the grant on the following conditions:—

- (1) The Bombay Government should be asked to provide for the cost of the buildings and fencing.
- (2) The usual condition of the grant being limited to five years be waived in this case and the Scheme be granted for ten years subject to a special review at the end of five years.
- (3) The Chairman of the Board should negotiate the possibility of the Bombay Government taking over the livestock at a valuation at the end of ten years. The Government of Bombay were not agreeable to the last condition.

The Governing Body which met in November 1933 did not sanction the Scheme.

3. The Scheme now submitted will in the first instance be considered by the Cattle-Breeding Committee of the Council and its report will be circulated to the Advisory Board in due course.

## ANNEXURE I.

COPY OF LETTER NO. 782/A./33, DATED THE 17TH DECEMBER 1934, FROM THE SECRETARY TO THE GOVERNMENT OF BOMBAY, REVENUE DEPARTMENT, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.

SUBJECT:—Goat-breeding Scheme. Grant from Imperial Council of Agricultural Research for —.

With reference to the correspondence ending with your letter No. D. 1053-V.-33, dated 9th November 1934, I am directed by the Government of Bombay (Transferred Departments) to forward a fresh scheme for goat-breeding research in the Presidency and to state that it was approved by the Provincial Agricultural Research Committee, subject to the omission of the disease section of the scheme. This omission will not, however, have any effect on the cost of the scheme.

2. The contribution of the Local Government towards the cost of the scheme will be restricted to an amount of Rs. 7,100 for meeting the expenditure on the buildings to be put up in connection with the scheme, to the use of the land in charge of the Agricultural Department, and to the supervision of the Livestock Expert and his staff. I am to add that the Government of Bombay strongly support the proposals and recommend the scheme for the favourable consideration of the Imperial Council of Agricultural Research.

## ANNEXURE II.

## GOAT BREEDING SCHEME.

APPLICATION FROM THE GOVERNMENT OF BOMBAY FOR A GRANT-IN-AID TO THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.

*The Scheme.*

The Scheme as given below is intended to produce an economical goat, which will be of immense value to the country. To quote from Dr. Robert McCarrison, Director of Nutritional Research, Coonoor, in his book entitled "Food" :—

"If the breed of goats and their milk yielding capacity were improved throughout India, as has been done in some places, it would be of great benefit to the people." Again later he quotes "If the food contains enough milk and milk products then it is not necessary to eat fresh meat at all—fresh milk in not less than one pint a day and a quart if possible, but few children in India consume anything like this amount."

The Scheme involves a fair expenditure, but when it is considered that any money spent in this direction is going towards the necessary food supply of the very poorest people of India, it is well worth it.

The goat at present is such a poor specimen that it helps very little in the milk production of this country. Goat's meat is also extensively used in some parts of India, it being preferred to sheep mutton.

In Western India, we have two very defined pure breeds of goat—(1) the Surti, and (2) the North Gujarat Goat. As far as one can see these are bred fairly pure, especially so the large, long haired, black goat of Northern Gujarat; flock of several hundred may be seen and these alike as two peas. The Gujarat goat is largely reared on grazing and is principally used for meat and hair production. The Surti—a small cream coloured hornless animal—is more domesticated and is reared on stall feeding. In these two breeds, we have the making of very useful animal, which I feel sure, would be appreciated in most parts of India.

The idea of the Scheme is to start with 100 does and 7 bucks of each breed, these to be located at three centres :—

- (i) Poona,
- (ii) Vadala (American Mission Vocational School and Rural Centre Vadala Mission, District Ahmednagar), and
- (iii) Anklesvar (Vocational Training School), District Broach.

At Poona we shall have 50 of each breed, and at Vadala and Anklesvar 25 of each breed.

The Scheme is intended to investigate the following :—

- (1) A study of two suitable breeds of Western India goats, the Surtis and the Gujaratis, which would include a study of the breeds, the inheritance of their characters, their feeding and management contributing to high milk production.
- (2) The conducting of feeding trials to ascertain the most suitable quantities and qualities of Indian feeding stuffs and their most desirable combinations for high milk production and growth.
- (3) An investigation of the comparative hygienic and food value of goat milk for feeding children, patients and invalids.

It is intended that these flocks should at no time exceed the number started with. Progeny from the best will annually replace those not doing so well. As these breeds to start with are fairly pure and since they will be bred pure, from the first year of the Scheme progeny will be placed out in suitable villages, the idea being to multiply these under village conditions and strictly under our control. We shall thus be working up centres from which large numbers of such improved goats will be available for those desirous of having them.

This Scheme conforms to recommendations of the Sub-Committees appointed to advise on Sheep and Goat Breeding.



The Scheme, therefore, has been mapped out to be conducted over a period of 10 years. The scheme will be supported by the Government of Bombay to the extent of 117 acres of land, the temporary housing, runs, etc. The Scheme will be conducted by the Live Stock Expert, Nutrition Assistant, Mr. I. W. Moomaw and Rev. R. W. Fairbank of the two institutions co-operating in the Scheme. These Missions will also provide land and buildings.

It is proposed to maintain the records of the Experiment in the attached four forms. The detailed expenditure required is given in the form of appendices :—

	Rs.	
1. Capital expenditure . . . . .	18,160	(Out of this Rs. 7,100 will be provided by the Government of Bombay).
2. Recurring expenditure . . . . .	1,11,250	
3. Income . . . . .	45,600	
4. Ten years working financial aspect of the running of the three stations.		

It may be here mentioned that there will be no difficulty of disposing of the stock at the end of the period of the Scheme. A demand now exists, and should the Government of Bombay's finances not permit of the Scheme being continued, it is safe to assume that other bodies will only be too pleased to take over the live-stock.

The Imperial Council of Agricultural Research is requested to subsidize with a total sum of Rs. 1,22,310 (Rs. 11,060 non-recurring and Rs. 1,11,250 recurring) excluding a provision of Rs. 7,100 to be made by the Government of Bombay, spread over ten years for the three experimental stations. The estimated income is Rs. 45,600 and the estimated value of live-stock at the end of the ten years period is Rs. 6,420 and that of structures and equipment is Rs. 3,550.

The land and structures will revert to the Government of Bombay and the Missions concerned on conclusion of the experiments.

(Signed) E. J. BRUEN,  
Live Stock Expert to Government,  
Bombay Presidency, Poona.

**PROPOSED GOAT BREEDING, FEEDING SCHEME AT POONA, VADALA AND ANKLESWAR.**

*Capital Expenditure*—(1) Land, (2) Structures, and (3) Miscellaneous.

Item.	1st year.
	Rs.
(1) Land—	
(i) At Poona—	
(a) 12 acres made available by Government of Bombay on land belonging to the Dairy Farm of the College of Agriculture, Poona.	
(b) 105 acres of Jungle land made available by Government of Bombay on Manjri Kuran Dry Dairy Cattle Farm, 11 miles distance from the College of Agriculture on Poona-Sholapur Road.	
(ii) At Vadala (American Mission Vocational School and Rural Centre, Vadala Mission, District Ahmednagar).	
Provided by the Mission.	
(iii) At Ankleswar (Vocational Training School), District Broach.	
Provided by the Mission.	
(2) Foundation stock—	
(i) At Poona—	
6 Males (3 Surti and 3 Gujarati) and 100 Females (50 Surti and 50 Gujarati) at Rs. 40 each	4,240
(Transport charges included.)	

	1st year Rs.
<b>(ii) At Vadala—</b>	
4 Males (2 Surti and 2 Gujarati) and 50 Females (25 Surti and 25 Gujarati) at Rs. 40 each . . . . .	2,160
(Transport charges included.)	
<b>(iii) At Anklesvar—</b>	
4 Males (2 Surti and 2 Gujarati) and 50 Females (25 Surti and 25 Gujarati) at Rs. 40 each . . . . .	2,160
(Transport charges included.)	
<b>(3) Pens, Yards, Quarters, etc.—</b>	
<b>(i) At Poona—</b>	
(1) Pens, Enclosures, etc.—	
2 sheds, 150' × 12' . . . . .	}
1 shed, 130' × 8' . . . . .	
1 shed, 60' × 8' . . . . .	
(2) Quarters—	
Flock Overseer, two rooms, 12' × 12' . . . . .	}
Two shepherds, two rooms, 12' × 12' . . . . .	
Office and Record room . . . . .	
Testing room, etc., 12' × 8' . . . . .	
Latrines, two 5' × 5' . . . . .	
Water pipe connection . . . . .	
	4,100
<b>(ii) At Vadala—</b>	
(1) Pens, Enclosures, etc.—	
1 shed, 75' × 12' . . . . .	}
1 shed, 40' × 8' . . . . .	
1 shed, 20' × 8' . . . . .	
(2) Quarters, Office room, Testing room, etc. . . . .	Provided.
<b>(iii) At Anklesvar —</b>	
(1) Pens, Enclosures, etc.—	
1 shed, 75' × 12' . . . . .	}
1 shed, 40' × 8' . . . . .	
1 shed, 20' × 8' . . . . .	
(2) Quarters, Office room, Testing room, etc. . . . .	Provided.
<b>Total</b> . . . . .	<b>7,100</b>
<b>(4) Miscellaneous Expenses—</b>	
Miscellaneous expenditure for the three stations (Poona, Vadala and Anklesvar) for—	
Portable weigh-bridges, spring balances, milking pails, chains, cans and collars, etc. . . . .	2,500
<b>Total</b> . . . . .	<b>2,500</b>
<b>Grand Total Capital Expenditure</b> . . . . .	<b>18,160</b>

**EXPENDITURE (4) RECURRING.**

Items.		1st year.	2nd year.	3rd year.	4th year.	5th year.	6th year.	7th year.	8th year.	9th year.	10th year.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
<b>(1) ESTABLISHMENT—</b>											
<b>(i) At Poona—</b>											
1 Flock Overseer at Rs. 35— 5/2—60	5,400	420	420	480	480	540	540	600	600	660	660
1 Head Flock man at Rs. 30 per mensem	3,600	360	360	360	360	360	360	360	360	360	360
5 Flock men and wives at Rs. 20 per mensem	12,000	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
<b>Total</b>	<b>21,000</b>	<b>1,980</b>	<b>1,980</b>	<b>2,040</b>	<b>2,040</b>	<b>2,100</b>	<b>2,100</b>	<b>2,160</b>	<b>2,160</b>	<b>2,220</b>	<b>2,220</b>
<b>(ii) At Vadala—</b>											
1 Head Flock man at Rs. 30 per mensem	3,600	360	360	360	360	360	360	360	360	360	360
3 Flock men and wives at Rs. 20 per mensem	7,200	720	720	720	720	720	720	720	720	720	720
<b>Total</b>	<b>10,800</b>	<b>1,080</b>	<b>1,080</b>	<b>1,080</b>	<b>1,080</b>	<b>1,080</b>	<b>1,080</b>	<b>1,080</b>	<b>1,080</b>	<b>1,080</b>	<b>1,080</b>
<b>(iii) At Anklewar—</b>											
1 Head Flock man at Rs. 30 per mensem	3,600	360	360	360	360	360	360	360	360	360	360
3 Flock men and wives at Rs. 20 per mensem	7,200	720	720	720	720	720	720	720	720	720	720
<b>Total</b>	<b>10,800</b>	<b>1,080</b>	<b>1,080</b>	<b>1,080</b>	<b>1,080</b>	<b>1,080</b>	<b>1,080</b>	<b>1,080</b>	<b>1,080</b>	<b>1,080</b>	<b>1,080</b>
<b>Grand total for three stations under "Establishment"</b>	<b>42,600</b>	<b>4,140</b>	<b>4,140</b>	<b>4,200</b>	<b>4,200</b>	<b>4,260</b>	<b>4,260</b>	<b>4,320</b>	<b>4,320</b>	<b>4,380</b>	<b>4,380</b>

## (2) CONTINGENCIES—

(1) Feeding Charges—											
(i) At Poona . . . . .	30,600	3,060	3,060	3,060	3,060	3,060	3,060	3,060	3,060	3,060	3,060
(ii) At Vadala . . . . .	15,300	1,530	1,530	1,530	1,530	1,530	1,530	1,530	1,530	1,530	1,530
(iii) At Anklesvar . . . . .	15,300	1,530	1,530	1,530	1,530	1,530	1,530	1,530	1,530	1,530	1,530

Total . . . . .	61,200	6,120	6,120	6,120	6,120	6,120	6,120	6,120	6,120	6,120	6,120
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## (2) Miscellaneous expenses for three stations—

(i) Medicines . . . . .	750	75	75	75	75	75	75	75	75	75	75
(ii) Sundries . . . . .	2,200	220	220	220	220	220	220	220	220	220	220
(iii) Stationery, stamps, etc. . . . .	1,500	150	150	150	150	150	150	150	150	150	150
(iv) Replacements and repairs . . . . .	3,000	300	300	300	300	300	300	300	300	300	300

Total . . . . .	7,450	745	745	745	745	745	745	745	745	745	745
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## (A) EXPENDITURE—

## (a) Capital—

## (1) Foundation stock—

(i) At Poona . . . . .	4,240	4,240	..	..	..	..	..	..	..	..	..
(ii) At Vadala . . . . .	2,160	2,160	..	..	..	..	..	..	..	..	..
(iii) At Anklesvar . . . . .	2,160	2,160	..	..	..	..	..	..	..	..	..

8,560
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## (2) (i) Pens and yards at Poona, Vadala and Anklesvar . . . . .

(ii) Structure—quarters at Poona . . . . .	7,100	7,100	..	..	..	..	..	..	..	..	..
(iii) Structure—Other buildings, such as, milking room, office, food stores, etc., at Poona . . . . .											

## (3) Miscellaneous expenses for three stations . . . . .

2,500	2,500	..	..	..	..	..	..	..	..	..	..
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Total . . . . .	18,160	18,160	..	..	..	..	..	..	..	..	..
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Items.		1st year.	2nd year.	3rd year.	4th year.	5th year.	6th year.	7th year.	8th year.	9th year.	10th year.
(A) EXPENDITURE— <i>contd.</i>	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
(b) <i>Contingent</i> —											
(1) Establishment at Poona, Vadala and Anklesvar	42,600	4,140	4,140	4,200	4,200	4,260	4,260	4,320	4,320	4,380	4,380
(2) Feeding—at Poona, Vadala and Anklesvar	61,200	6,120	6,120	6,120	6,120	6,120	6,120	6,120	6,120	6,120	6,120
(3) Miscellaneous expenses at Poona, Vadala and Anklesvar	7,450	745	745	745	745	745	745	745	745	745	745
Total	1,11,250	11,005	11,005	11,065	11,065	11,125	11,125	11,185	11,185	11,245	11,245
(a) and (b)—Grand Total	1,29,410	29,165	11,005	11,065	11,065	11,125	11,125	11,185	11,185	11,245	11,245
(B) INCOME—											
Income—Grand Total	45,600	2,140	2,140	3,240	3,240	4,340	4,340	5,440	5,440	7,640	7,640
(A) <i>By sale of milk</i> —											
(i) At Poona—(at 16 lbs. per rupee)	13,000	750	750	1,000	1,000	1,250	1,250	1,500	1,500	2,000	2,000
150 lbs. × 80 Goats for 1st and 2nd year.											
200 lbs. × 80 Goats for 3rd and 4th year.											
250 lbs. × 80 Goats for 5th and 6th year.											
300 lbs. × 80 Goats for 7th and 8th year.											
400 lbs. × 80 Goats for 9th and 10th year.											

(ii) At Vadala—(at 16 lbs. per rupee)	6,500	375	375	500	500	625	625	750	750	1,000	1,000
150 lbs. × 40 Goats for 1st and 2nd year.											
200 lbs. × 40 Goats for 3rd and 4th year.											
250 lbs. × 40 Goats for 5th and 6th year.											
300 lbs. × 40 Goats for 7th and 8th year.											
400 lbs. × 40 Goats for 9th and 10th year.											
(iii) At Anklesvar—(at 16 lbs. per rupee)	6,500	375	375	500	500	625	625	750	750	1,000	1,000
150 lbs. × 40 Goats for 1st and 2nd year.											
200 lbs. × 40 Goats for 3rd and 4th year.											
250 lbs. × 40 Goats for 5th and 6th year.											
300 lbs. × 40 Goats for 7th and 8th year.											
400 lbs. × 40 Goats for 9th and 10th year.											
(B) By sale of kids and discards—											
(i) At Poona—	9,600	300	300	600	600	900	900	1,200	1,200	1,800	1,800
60 at Rs. 5 for the 1st and 2nd year.											
60 at Rs. 10 for the 3rd and 4th year.											
60 at Rs. 15 for the 5th and 6th year.											
60 at Rs. 20 for the 7th and 8th year.											
60 at Rs. 30 for the 9th and 10th year.											

Items.		1st year.	2nd year.	3rd year.	4th year.	5th year.	6th year.	7th year.	8th year.	9th year.	10th year.
(B) INCOME— <i>contd.</i>	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
(B) <i>By sale of kids and discards— contd.</i>											
(ii) At Vadala—	4,800	150	150	300	300	450	450	600	600	900	900
30 at Rs. 5 for the 1st and 2nd year.											
30 at Rs. 10 for the 3rd and 4th year.											
30 at Rs. 15 for the 5th and 6th year.											
30 at Rs. 20 for the 7th and 8th year.											
30 at Rs. 30 for the 9th and 10th year.											
(iii) At Anklesvar—	4,800	150	150	300	300	450	450	600	600	900	900
30 at Rs. 5 for the 1st and 2nd year.											
30 at Rs. 10 for the 3rd and 4th year.											
30 at Rs. 15 for the 5th and 6th year.											
30 at Rs. 20 for the 7th and 8th year.											
30 at Rs. 30 for the 9th and 10th year.											
(C) <i>By sale of manure—</i>											
At Poona Rs. 20 per annum .	200	20	20	20	20	20	20	20	20	20	20
At Vadala Rs. 10 per annum .	100	10	10	10	10	10	10	10	10	10	10
At Anklesvar Rs. 10 per annum . . . . .	100	10	10	10	10	10	10	10	10	10	10
Grand Total . . . . .	45,600	2,140	2,140	3,240	3,240	4,340	4,340	5,440	5,440	7,640	7,640

*Ten Year Working Financial Aspect of the Running of the Three Stations.*

Liabilities.	Rs,	Assets.	Rs.
Capital cost—		1. Income . . . . .	45,600
Foundation stock for three stations	Rs. 8,560	2. Value of stock on hand—	
Pens, enclosures quarters, milking shed, office, food store, etc. . . . .	7,100	Live stock . . . . .	Rs. 6,420*
Miscellaneous ex- penses for three stations . . . . .	2,500	Pens, enclosures, quarters, etc. . . . .	3,550
	18,160	Loss due to experiments at three stations . . . . .	9,970
Recurring expenses	1,11,250		
Total . . . . .	1,29,410	Total . . . . .	1,29,410

\*Note.—This does not show the valuation of the live-stock but the purchasing power of a cultivator.

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



## FORM No. 1.

## YOUNG STOCK REGISTER.

*Females.*

Number.	Date of birth.	Sire.	Dam.	Date served.	Disposal and remarks.

## FORM No. 2.

## YOUNG STOCK REGISTER.

*Males.*

Num-ber.	Date of birth.	Sire.	Dam.	Disposal and remarks.







No. 4.

SHEET.

Breed.....

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{ ..... } .....  
{ ..... } .....

{ ..... } .....  
{ ..... } .....

Maximum yield a day.	Average milk yield during lactation.	Number of days.		Hospital and illness record.		Remarks.
		In milk.	Dry.	Disease.	Date from and to.	

## APPENDIX XXXIII.

NOTE DATED: THE 4TH FEBRUARY 1935, BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT No. 38 :—APPLICATION FROM MR. J. J. DE VALOIS, PRINCIPAL, AMERICAN ARCOT MISSION AGRICULTURE INSTITUTE, KATPADI, FOR A GRANT OF RS. 84,172 (RS. 5,480 NON-RECURRING AND RS. 78,692 RECURRING) FOR GOAT BREEDING IN THE MADRAS PRESIDENCY SPREAD OVER A PERIOD OF TEN YEARS.

Attention is invited to the letter from the Government of Madras No. 69, dated the 12th January 1935, (Annexure I) forwarding a revised scheme for research in goat breeding (Annexure II). The scheme is estimated to cost Rs. 84,172 (Rs. 5,480 non-recurring and Rs. 78,692 recurring) spread over a period of ten years. Against this cost there is an estimated income of Rs. 16,890 reducing the total cost to a net amount of Rs. 67,282. The land and building will be provided by the American Arcot Mission and the Principal of the Agricultural Institute will supervise the work free of cost.

2. The original scheme was considered by the Standing Cattle Breeding Committee and the Advisory Board in September 1934 and the revised scheme has been drawn upon the lines recommended by the Cattle Breeding Committee. The revised scheme will be considered by the Cattle Breeding Committee for scrutiny and their report will be circulated to the Board in due course.

## ANNEXURE I.

COPY OF LETTER No: 69, DATED THE 12TH JANUARY 1933, FROM THE SECRETARY TO THE GOVERNMENT OF MADRAS, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.

I am directed to forward the scheme of research on Goat breeding as now revised by Mr. J. J. De Valois of the Agricultural Institute, Katpadi on the lines indicated by the Standing Cattle Breeding Committee of the Council. The revised scheme has not been placed before the Provincial Research Committee.

2. \* \* \* \* \*

## ANNEXURE II.

## RESEARCH WORK IN GOAT BREEDING.

Details of the research work proposed to be carried out by the American Arcot Mission Agricultural Institute, Katpadi, North Arcot district, Madras Presidency, with the subsidy asked for from the Imperial Council of Agricultural Research, New Delhi.

## INTRODUCTION.

In connexion with my activities in Rural Reconstruction in the villages of South India the past twelve years, I have been impressed with the fact that the depressed classes and smaller village ryots find it almost impossible to raise and maintain a decent breed of milk cattle. They cannot afford the initial outlay nor take the chance on mortality resulting from the numerous diseases and difficulties arising from present village conditions and communal grazing. As milk is such an essential item in the diet, I am persuaded that the goat, the "poor man's cow" should receive more attention. The goats as found in the South Indian villages are of a very poor grade. No systematic improvement work has yet been undertaken by any agency either official or non-official. Much prejudice exists against the use of goat milk which can only be broken down by a vigorous educational programme with actual demonstrations.

The Madras Presidency is reported to have some eleven million goats of a non-descript variety. Among them we find great differences as to colour, size, milking capacity, and other characteristics usually associated with a definite breed. The purpose of this research project would be to make a concentrated attempt to select certain types and strains and with a definite ideal in mind work toward consolidating such desirable characteristics into a definite breed indigenous to South India. A few Jumna-Pari and Surti males would also be introduced from other provinces and crossed with local females in an attempt to use certain characteristics for developing the type we have in mind. This method is in line with breeding programmes that have been carried out in various countries in developing our present breeds of poultry and live-stock.

#### *Lines of research.*

Our object would be to follow the following main lines of research :—

- (1) Selective breeding of the best local goat bred pure along certain lines in an attempt to fix certain characteristics. We would select several types at first in an attempt to see which lines prove most encouraging.
- (2) Cross breeding about one-fourth of the does with selected Jumna-Pari males to fix certain characteristics as may develop and prove valuable.
- (3) Using pure bred Surti males with about one-fourth of the does the same as (2) above.
- (4) Comparative data would be available to determine the suitability of various types and strains maintained under similar conditions.

#### *Objects of the experiment.*

Careful records would be kept covering the following :—

- (1) Comparative milk production of the various crosses and selected animals.
- (2) Comparative hardiness and prolificacy of each type of cross.
- (3) Age of maturity in each type.
- (4) Milking longevity.
- (5) Comparison of average interval between kiddings.
- (6) The estimated average value of hair, hide and carcass.
- (7) Suitability of various concentrated feeds and fodders for goat raising in South India.
- (8) Observations of diseases of goats and their treatment under the supervision of the Madras Veterinary Department.

#### *Details of expenditure.*

1. *Staff.*—(a) Mr. J. J. De Valois, B.Sc., in Agricultural and Animal Husbandry of Iowa State College with special training in genetics, live-stock breeding, judging and feeding, will supervise the research work. Mr. De Valois has had fourteen years' experience with Indian conditions. This supervision to be given free by the mission.

(b) An Indian Dairy Diploma or Agricultural College graduate assistant on Rs. 80—4—100 scale.

(c) Office clerk on Rs. 30—2—40 scale.

(d) One maistri or head shepherd, Rs. 25.

(e) Unskilled labourers to care for the flock—four men the first year; five the second and six last eight years of the experiment at Rs. 12 per month each.



Rs.

**2. Live-stock—**

(a) Two Jumna-Pari male will be imported from North India and two Surti males from West India the first year and one of each breed again in the fifth year of the experiment, to use in cross-breeding. The cost per animal will be Rs. 50 inclusive of shipping costs . . . . .	300
(b) One hundred selected country females and two males will be brought the first year ; 50 females the second year ; 50 females and two males, the third year and two males the fifth year making 206 animals at the average of Rs. 15 each . . . . .	3,090
(c) Goats would be selected from various parts of South India as found suitable for our purposes. We will assume that 100 goats will be imported at Rs. 4 for shipment . . . . .	400
(d) As personal selection will be necessary and will involve considerable travel we should assign an amount to cover this necessary expenditure . . . . .	400
<b>Total</b> . . . . .	<b>4,190</b>

3. *Buildings.*—The Imperial Council has intimated that they will not be in a position to grant any assistance for buildings. The Madras Government has been consulted as to the possibility of a grant for this purpose but possibilities are that nothing may be available at the present time. We hope that later the Local Government may find it possible, to assist us if it can possibly do so in view of the fact that this experiment will be of great value for South India. For the present the Agricultural Institute is prepared to build the necessary buildings in an inexpensive manner yet suitable for the carrying on of the work in a sanitary and efficient way which will also be a good demonstration for village farmers who we hope will take to this branch of live-stock work following our example.

The following buildings will be required :—

- (1) House for the Indian Graduate Assistant; quarters for maistri and coolies.
- (2) Main goat shed for the milking herd.
- (3) Separate sheds for males which can also be used as serving pens.
- (4) Shed for the dry herd, goatings and kids.
- (5) Isolation shed and sick room.
- (6) Dairy shed and office.
- (7) Fencing for runs and paddocks.

4. *Equipment.*—(a) Office requirements, i.e., tables, chairs, almirahs, desks, type-writer, filing, cabinets, etc.

(b) *Dairy equipment.*—Weighing scale, spring balance scales, milk-cans, strainers, measures, thermometers, babcock-tester, castrator, collars and chains, number tags and tattoo marker, medicines, and surgical supplies.

5. *Land.*—In 1922, the Government of Madras alienated to the Arcot Mission 175 acres of land to be utilized for an Agricultural school and demonstration farm. Of this area about 50 acres has been brought under cultivation, 35 acres has been devoted to buildings, school, playground, poultry runs, etc., leaving a considerable area for grazing purposes which can well be utilized for paddocks and grazing for the goat herd. About 2 acres of fodder crops will have to be grown.

6. *Maintenance charges.*—(a) Concentrated feeds, fodder and grazing charges to be estimated at Rs. 18 per adult goat per year and Rs. 12 per kid and goatling per year. These estimates are based on actual costs at the Mission Poultry Farm, United Provinces.

## (b) Recurring office and farm contingencies :—

	Per year. Rs.
(1) Books, periodicals, stationery, stamps, etc. . . . .	150
(2) Dairy expenses . . . . .	50
(3) Medicines and veterinary supplies . . . . .	120
(4) Repairs to buildings, fences, etc. . . . .	200
(5) Miscellaneous expenses . . . . .	100
Total	620

*Details of income expected.*

	Rs.
1. <i>By sale of milk.</i> —The Agricultural Institute is located eight miles from Vellore the nearest city where milk can be sold in large quantities. We therefore assume that it will not be possible to realize more than an average of Rs. 3 per year from each adult female in the herd. Our first aim will be to allow the young kids all the milk they can manage. We assume that there will be 100 adult females the first year; 150 the second year; and 200 for each of the remaining eight years of the experiment making 1,850 animal units at Rs. 3 or Rs. 5,550 income . . . . .	5,550
2. <i>By sale of stock during the ten year experiment—(a) Male kids.</i> —These will be disposed of at the age of six months ordinarily at an estimated average price of Rs. 4. It is estimated that we will be able to dispose of 50 and 75 in the second and third years respectively and 100 each of the last seven years of the experiment. This would make 825 head or Rs. 3,300 from this item . . . . .	3,300
(b) Culled does and young female kids. Females that fail to measure up to our standards will be culled. Some of the doe kids that fail to show promise or are slightly defective will also be sold. It is estimated that we would have 20 such animals the third and fourth years and 80 each of the last six years of the trial. We should be able to sell these at Rs. 7 each on the average making a total of Rs. 3,640 from the 520 animals so disposed of . . . . .	3,640
(c) Better grade females. In order to keep our flock within the limit of 200 adult females we estimate that we will have 20 better grade females each of the last six years that we should be able to dispose of at Rs. 10 per animal making Rs. 1,200 for the 120 animal units . . . . .	1,200
3. Sale of stock at the end of the experiment. We should have 200 females worth Rs. 15 each and eight males worth Rs. 25 each making a total of Rs. 3,200 income at the conclusion of the experiment . . . . .	3,200
Total	16,890

*Conclusion.*—The Agricultural Institute is located four miles from the Katpadi Railway station quite accessible to the public who would be interested in following the results of the goat breeding experiment. The Agricultural Institute is already carrying on an extensive poultry farm drawing a large number of visitors. Many other crops and live-stock projects are also being demonstrated to the public, such as the breeding of Kangayam and Scindhi cattle, pig raising, mango grafting, and fruit farming, vegetable growing, etc. In all this work we are receiving the hearty co-operation and assistance of the Madras Agricultural Department.

Associated with the Demonstrated Farm is a boys' boarding home with 80 students and a central village school together forming a higher elementary school of 130 students which also receives the hearty co-operation of the Education Department and is well subsidized by them. All these students take work in agriculture giving their literary training a practical bias. These boys are all in training for village work and would be greatly interested in the experiment as well as being in a position later to introduce the improved breed of goats into their villages.

A rural reconstruction summer school is also held at the Agricultural Institute yearly which is attended by 50 or more students. The advantages of goat raising would be demonstrated to these leaders. The Institute also carries a staff of extension workers who go into the district demonstrating improved agricultural practices on the ryots' own lands in the village. The Arcot Mission also has occupied 250 villages in each of which is stationed one or more teachers also serving the purpose of working for village uplift. Considerable work is also being carried on through lectures and contracts with District Board schools. So far as time and money allows the institute attempts to spread its influence for rural improvement without prejudice to caste or creed. The objective would ultimately be to supply pedigreed breeding stock for our own rural reconstruction units as well as to make them available for other public or private bodies in the South Indian Provinces for goat improvement work.

The Arcot Mission is prepared to give the services of Mr. J. J. De Valois, the Principal of the Agricultural Institute, Katpadi, free to supervise this project which will entail considerable time and attention. We are also prepared to make available the necessary building land, housing arrangements for staff in the interests of the experiment. We hope that this will ultimately be of great benefit to the many goat breeders in India and especially so for the poorer classes of people who will be taught the value of utilizing the products of the "poor man's cow".

We therefore appeal to the Imperial Council of Agricultural Research to favourably consider this scheme and place the necessary funds at our disposal to be used along with our local contribution for research work on goats for South Indian Provinces and its ultimate extension into village work if the experiment proves the desirability of so doing. We can assure the Council that the work will be done with great care and in full co-operation with the Madras Agricultural and Veterinary departments who have always assisted us so generously.

J. J. DE VALOIS.

KATPADI,

15th December 1934.

APPENDIX A.

Summary of expenditure.

	First year.	Second year.	Third year.	Fourth year.	Fifth year.	Sixth year.	Seventh year.	Eighth year.	Ninth year.	Tenth year.	Total.
<b>I. Capital Expenditure—</b>											
1. Purchase of stock . . . . .	2,530	750	780	..	130	..	..	..	..	..	4,190
2. Office equipment . . . . .	690	..	..	..	..	..	..	..	..	..	690
3. Dairy equipment . . . . .	600	..	..	..	..	..	..	..	..	..	600
<b>Total</b>	<b>3,820</b>	<b>750</b>	<b>780</b>	<b>..</b>	<b>130</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>5,480</b>
<b>II. Staff—</b>											
1. Assistant . . . . .	960	1,008	1,056	1,104	1,152	1,200	1,200	1,200	1,200	1,200	11,280
2. Writer . . . . .	360	384	408	432	456	480	480	480	480	480	4,440
3. Maistry-Shepherd . . . . .	300	300	300	300	300	300	300	300	300	300	3,000
4. Coolies . . . . .	576	720	864	864	864	864	864	864	864	864	8,208
<b>Total</b>	<b>2,196</b>	<b>2,412</b>	<b>2,628</b>	<b>2,700</b>	<b>2,772</b>	<b>2,844</b>	<b>2,844</b>	<b>2,844</b>	<b>2,844</b>	<b>2,844</b>	<b>26,928</b>
<b>III. Feeding costs—</b>											
1. Adult—Males at 18 . . . . .	108	108	144	144	180	180	180	180	180	180	1,584
2. Adult—Females at 18 . . . . .	1,800	2,700	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	33,300
3. Kids and goatlings at 12 . . . . .	360	720	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	10,680
<b>Total</b>	<b>2,268</b>	<b>3,328</b>	<b>4,944</b>	<b>4,944</b>	<b>4,980</b>	<b>4,980</b>	<b>4,980</b>	<b>4,980</b>	<b>4,980</b>	<b>4,980</b>	<b>45,564</b>
<b>IV. Office, etc.</b>	<b>620</b>	<b>620</b>	<b>620</b>	<b>620</b>	<b>620</b>	<b>620</b>	<b>620</b>	<b>620</b>	<b>620</b>	<b>620</b>	<b>6,200</b>
<b>V. Total yearly cost—</b>											
(i) Capital expenditure . . . . .	3,820	750	780	..	130	..	..	..	..	..	5,480
(ii) Staff . . . . .	2,196	2,412	2,628	2,700	2,772	2,844	2,844	2,844	2,844	2,844	26,928
(iii) Feeding costs . . . . .	2,268	3,528	4,944	4,944	4,980	4,980	4,980	4,980	4,980	4,980	45,564
(iv) Office . . . . .	620	620	620	620	620	620	620	620	620	620	6,200
<b>Total</b>	<b>8,904</b>	<b>7,310</b>	<b>8,972</b>	<b>8,264</b>	<b>8,502</b>	<b>8,444</b>	<b>8,444</b>	<b>8,444</b>	<b>8,444</b>	<b>8,444</b>	<b>84,172</b>

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APPENDIX E.

Summary of income.

Particulars	First year.	Second year.	Third year.	Fourth year.	Fifth year.	Sixth year.	Seventh year.	Eighth year.	Ninth year.	Tenth year.	Total.
I. Sale of milk . . . . .	300	450	600	600	600	600	600	600	600	600	5,550
II. Sale of stock—											
1. Male kids at Rs. 4 . . . . .	..	200	300	400	400	400	400	400	400	400	3,300
2. Female kids . . . . .	..	140	140	480	480	480	480	480	480	480	3,640
3. Does . . . . .	..	..	..	..	200	200	200	200	200	200	1,200
4. Stock at close . . . . .	..	..	..	..	..	..	..	..	..	3,200	3,200
Total . . . . .	..	340	440	880	1,080	1,080	1,080	1,080	1,080	4,280	11,340
III. Total yearly income—											
I. Sale of milk . . . . .	300	450	600	600	600	600	600	600	600	600	5,550
II. Sale of stock . . . . .	..	340	440	880	1,080	1,080	1,080	1,080	1,080	4,280	11,340
Total . . . . .	300	790	1,040	1,480	1,680	1,680	1,680	1,680	1,680	4,880	16,890

Final summary.

1. Total yearly expenditure . . . . .	8,904	7,310	8,972	8,264	8,502	8,444	8,444	8,444	8,444	8,444	84,172
2. Total yearly income . . . . .	300	790	1,040	1,480	1,680	1,680	1,680	1,680	1,680	4,880	16,890
3. Net yearly expenditure . . . . .	8,604	6,520	7,932	6,784	6,822	6,764	6,764	6,764	6,764	3,564	67,282

## APPENDIX XXXIV.

NOTE DATED THE 11TH FEBRUARY 1935, BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT NO. 16.—APPLICATION FROM THE GOVERNMENT OF BOMBAY FOR GRANT OF RS. 51,136 SPREAD OVER A PERIOD OF 5 YEARS FOR RESEARCH IN POULTRY HUSBANDRY.

At its meeting held in August 1933, the Advisory Board considered a scheme of Poultry Breeding from the Government of Bombay. The estimated cost of the scheme was Rs. 52,995, the anticipated income was Rs. 28,000 and it was estimated that at the end of five years stock and buildings valued at Rs. 11,950 would be left on the farm. The Advisory Board recommended that a net grant of Rs. 13,045 be made after taking into account the two items mentioned above, and this recommendation was accepted by the Governing Body. The Government of Bombay were, however, unable to accept the net grant as sanctioned by the Council.

2. The Government of Bombay have now submitted a fresh scheme involving a total expenditure of Rs. 61,053 (Rs. 22,023 non-recurring and Rs. 39,030 recurring). (Annexure). They are prepared to meet Rs. 4,653 on account of capital expenditure and Rs. 6,253 on account of recurring expenditure. The estimated income is Rs. 3,664 only. The Council is asked to meet Rs. 51,136 only.

3. The scheme will be placed before the Cattle Breeding Committee and their report circulated to the Advisory Board in due course.

## ANNEXURE.

## A SCHEME FOR RESEARCH IN POULTRY HUSBANDRY TO BE CONDUCTED IN THE BOMBAY PRESIDENCY.

The proposed Scheme is spread over a period of five years with the Capital and Recurring Expenditure and the Probable Income as under :—

1. Capital Expenditure for all the three stations :—	Rs.	Rs.
(1) Government Central Poultry Farm, Kirkee . . . . .	11,491	
(2) American Mission Vocational School and Rural Centre, Vadala Mission, District Ahmednagar . . . . .	5,277	
(3) Vocational Training School, Anklesvar, District Broach . . . . .	5,255	
	22,023	
2. Recurring Expenditure for all the three stations :—		
(1) Government Central Poultry Farm, Kirkee . . . . .	14,290	
(2) American Mission Vocational School and Rural Centre, Vadala Mission, District Ahmednagar . . . . .	11,570	
(3) Vocational Training School, Anklesvar, District Broach . . . . .	11,570	
(4) For replacing Indian stock, a provision of Rs. 100 per year for 4 years . . . . .	400	
(5) For bringing fresh blood into stock every second year . . . . .	1,200	
	39,030	
Grand Total estimated expenditure . . . . .		61,053
<i>Deduct—</i>		
(1) To be provided by the Government of Bombay :—		
<i>Capital expenditure—</i>		
(a) Incubator House . . . . .	2,000	
(b) Foundation stock . . . . .	2,853	

Recurring expenditure—	Rs.	Rs.
(a) For replacing Indian stock . . . . .	400	
(b) For bringing fresh blood . . . . .	1,200	
	<hr/>	6,253
(2) Probable Income for the period of the Scheme . . . . .		3,664
		<hr/>
		9,917
Net provision to be made by the Imperial Council of Agricultural Research . . . . .		51,136

NOTE.—In addition, the Government of Bombay will provide for the following :—

(1) Supervising Staff :—

The Live Stock Expert to Government with his Nutrition Assistant.

Rev. R. W. Fairbank, Vadala.

Mr. I. W. Moomaw, Anklesvar.

(2) Land for all the three stations.

(3) Staff quarters.

#### RESEARCH IN POULTRY HUSBANDRY TO BE CONDUCTED IN THE BOMBAY PRESIDENCY.

That there are great possibilities in Poultry Keeping, both on a large commercial scale and as a cottage industry, has been proved in many parts of India. Conditions in India are so varied that it is not possible without careful investigation to produce breeds or types that will be useful under these different conditions prevailing.

To conduct such experiments knowledge of the business is essential plus a fair amount of expenditure which cannot be made available under present Provincial financial stringency.

This Presidency is very favourably situated for Poultry Investigation; firstly,—a well-equipped Farm exists at the headquarters of the Live Stock Expert and his Nutrition Assistant. To enable the Scheme to provide data and information of all-India importance, all that is needed are certain facilities of housing and staff. We intend in this Scheme to improve certain Indian breeds, which at present exist and which offer great possibilities. Apart from improving these firstly by purifying the breed and then fixing breed characters, we shall endeavour to improve on them by the judicious introduction of European blood at certain stages of our improvement and then fix the type.

At the two proposed sub-stations we are fortunate in having experienced and highly-qualified Missionary gentlemen, who are prepared to supervise their stations free of charge, provided that they are given the facilities enunciated in the Scheme. It will be seen that the facilities offered by the Bombay Presidency are unique. If such a Scheme were put up anywhere else, it would cost at least four times the expenditure now proposed.

Agriculturists in many parts in India through force of circumstances cannot fill in their time during a great portion of the year; some form of subsidiary occupation is essential, Poultry keeping fills the bill.

As a home or cottage industry for the poor labouring classes, it has no equal. To make this industry still more useful in India, investigations of the following are essential :—

(1) Study of a few of the European and American breeds, particularly Mediterranean breeds, that have proved themselves more or less suitable.

(2) A study and purifying of a few of the better known Indian breeds or breeds that have been known to exist in India for many years, such as, (a) The White Chittagong or Bramhaputra, (b) The Karaknath, the breed as the name denotes is evidently a spirited hardy breed, having a tuft of feathers on the head, evidently of foreign origin, said to be the best Deshi breed in the U. P., (c) Along the west coast of the Bombay Presidency, the author of this Scheme came across a breed of fowls with a Naked Neck known in these parts to lay many and large eggs; the breed commands a bigger price than the ordinary Deshi in the market. It is known as the "Govagiri" (i.e.) coming from Goa and "Firangi" meaning foreign. It has been bred so long that it may now be considered an Indian breed. In European books on Poultry, a breed of Naked Neck is mentioned and is known as "Turkey Neck, Naked Neck and Gilli Kens." In Wright's book on Poultry edited by S. A. Lewis, the

Following remarks are offered regarding a Naked Neck breed. The same authority says that the economic merits of this curious fowl are considerable. It is said to be very hardy, a moderate eater and a good layer, the eggs being of considerable size. It is also a very satisfactory breed. The young chicks are said to be particularly hardy as regards the thriving in inclement weather, their ancestors having been bred on the rugged slopes of the Carpathian Mountains, in Austria and in Transylvania.

These remarks tally with what was seen of the breed along the western coast. The origin of the breed is given as the Carpathian Mountains, Austria and Transylvania. However, whatever be the origin, it is sure that the breed is now acclimatised to Indian conditions and should prove good material to work on. At one time the Portuguese authorities prohibited the export of this breed from Portuguese India into British India. Many ingenious devices for bringing these out were resorted to.

(3) The combination of useful characters of foreign and Indian breeds by crossing.

(4) Investigation into the different types of Poultry farming, intensive, semi-intensive types for would-be pedigree breeders and the free Range System for purely farmers.

(5) Investigating modern hygienic methods of housing, which is to include cheap types of houses, runs and appliances to suit the poorer class of people.

(6) Investigation into incubation, artificial and natural, testing eggs, storing eggs, hatching and marketing, packing and transport.

(7) Investigation in Nutrition including feeding with cheap foods available in villages.

(8) Investigation into the best methods of introducing better poultry keeping in villages, co-operative marketing, etc., etc.

(9) Methods of passing on knowledge obtained into villages.

To enable this Programme of Work to be carried out, it is proposed to divide the work up into three Centres :—

(1) Government Central Poultry Farm, Kirkee, under the Live Stock Expert to Government, B.P., Poona.

(2) American Mission Vocational School and Rural Centre, Vadala Mission, District Ahmednagar, under Rev. R. W. Fairbank.

(3) Vocational Training School, Anklesvar, District Broach, under Mr. I. W. Moomaw.

Both Mr. Moomaw and Rev. Fairbank are highly qualified men having considerable experience in Poultry Farming.

It is proposed to divide this work up as follows :—

*Government Central Poultry Farm, Kirkee—*

Breeding research will be duplicate, all work being done at the two other centres, and I investigate the problem of keeping fowls for egg production only.

The breeding of improved varieties of Ducks for table and egg production, the breeds suggested being "The Indian Runner" and "Khaki Campbell". Ducks do well in India, are not so liable to disease as fowls. In England, the egg-laying capacity of a duck equals and if not excels the fowl. Duck keeping as a secondary occupation will be very suitable to many parts of India.

*At American Mission Vocational School and Rural Centre, Vadala Mission, District Ahmednagar—*

*Breeds.*—White Leghorn, Black Minorca and White Chittagong pure and by crossing to investigate the possibility of producing a more useful fowl for introducing to villages cheap housing, incubation natural and artificial, research in poultry foods, especially foods readily available, poultry as a secondary occupation, investigating best methods of storing eggs for hatching and table; the collection and marketing of large eggs and most suitable periods for hatching. In Western countries hatching is conducted from October to March. In India from the small experience we have had, I find that hatching between November and February are good but later it gets hot and there is great loss by dead chicks in shell. We propose to investigate the possibility of hatching in the monsoon when the humidity is greater.



(3) *At Vocational Training School, Anklesvar, District Broach—*

It is proposed to breed the Rhode Island Red, Light Sussex and the Naked Neck breed pure. To cross these European breeds with the Indian hens, with an idea of producing, if possible, a breed of better utility, that will stand the climate and conditions of Indian villages.

*Housing.*—To investigate methods of cheap yet effective housing and runs.

*Nutrition.*—To investigate the possibility of raising poultry on foods readily available in villages.

*Propaganda and Marketing.*—To investigate the best methods of introducing poultry into villages, the collection and marketing of village eggs.

All birds kept under this Scheme will be leg banded or suitably marked and details of all work will be suitably recorded.

As I have said, poultry keeping is nothing new to India, in every village one sees fowls but these are of very poor quality. They lay few eggs and these of small size that they command very poor prices.

With the present system of marketing, the poultry keeper makes nothing, the profit at present going to the middle man. To remedy this, we need a fowl that will lay more and better eggs and we need to educate the farmer or producer in better methods of marketing.

The information collected under this Scheme will be of great importance to the whole of India. We shall produce a suitable bird and at the same time be able to investigate cheap methods of keeping fowls, storage of eggs and marketing. When once established, the centres at which we are working can be utilised as training grounds for either village or Rural Uplift teachers or those interested in introducing Poultry Keeping as a profitable secondary occupation.

The expenditure proposed on housing and runs will be of very little value after the experiment is completed, that it is proposed to hand these over to stations concerned. In the case of livestock, these will be available for sale at purely local price to other Provinces, which may be interested in Poultry Keeping. A large number of hatching eggs and livestock will be utilized in investigation into the methods to be adopted in villages.

The records are proposed to be maintained in the enclosed forms (7).

*Livestock—*

It is proposed to keep two breeding pens of each breed at each centre; thus shall start with :—

(1) At Government Central Poultry Farm, Kirkee :—

	Rs.
One Pen, Naked Neck, 10 hens and 1 cock at Rs. 5 each . . .	55
One Pen, Chittagong, 10 hens and 1 cock at Rs. 6 each . . .	66
One flock of :—	
25 hens and 2 cocks of white Leghorn breed	
25 hens and 2 cocks of Rhode Island Red breed at Rs. 10 per bird	
(54 × 10) . . . . .	540
Two Pens—16 Ducks and 2 Drakes at Rs. 45 each, including freight, packing, insurance, etc. . . . .	810
One Pen—Black Minorca, 10 hens at Rs. 10 each, and 1 cock at Rs. 25 each . . . . .	125
One Pen—Light Sussex, 10 hens at Rs. 10 each, and 1 cock at Rs. 25 each . . . . .	125
Total . . . . .	1,721

	Rs.
(2) At American Mission Vocational School and Rural Centre, Vadala Mission, District Ahmednagar :—	
2 Pens—20 hens and 2 cocks, White Leghorn breed at Rs. 10 each	220
2 Pens—20 hens and 2 cocks, Chittagong breed at Rs. 6 each	132
1 Pen—10 hens at Rs. 10 and 1 cock at Rs. 25 each, Black Minorca breed	125
Total	477
(3) At Vocational Training School, Anklesvar, District Broach :—	
2 Pens—20 hens and 2 cocks of Rhode Island Red breed at Rs. 10 each	220
2 Pens—20 hens and 2 cocks of Naked Neck breed at Rs. 5 each	110
1 Pen—10 hens and 1 cock of Light Sussex breed at Rs. 10 and 25 each respectively	125
Total	455

Thus the estimated expenditure on Foundation Stock for all the three Stations would arrive at :—

	Rs.
(1) . . . . .	1,721
(2) . . . . .	477
(3) . . . . .	455
Total	2,653

In each station where we are dealing with foreign breeds, it will be essential to import male stock every second year to bring fresh blood into the stock, it is proposed that a lump sum of Rs. 600 every second year be provided for this; thus in five years, we shall require Rs. 1,200 (excluding Foundation Stock).....Rs. 1,200

The Indian stock will also need new blood, and a provision of Rs. 100 a year for each year is suggested, viz., Rs. 400.....Rs. 400

The probable cost of the Scheme would be as follows :—

#### CAPITAL EXPENDITURE.

##### *Government Central Poultry Farm, Kirkee—*

	Rs.
(1) Incubator House—One provided by the Local Government	2,000
(2) Addition and alteration to above	1,000
(3) Duck Pond	170
(4) Providing necessary housing and runs	5,500
(5) Water pipe connection to runs and houses	300
(6) Four small incubators Hot Air and Hot Water for individual hatching at Rs. 100 each	400
(7) Miscellaneous instruments, egg boxes, and other small appliances	400
(8) Livestock—Purchase of Foundation Stock	1,721
Total	11,491

	Rs.
<i>(2) American Mission Vocational School and Rural Centre, Vadala Mission, District Ahmednagar—</i>	
(1) Livestock—Purchase of Foundation stock . . . . .	477
(2) Housing yards, etc., etc. . . . .	3,600
(3) Equipment, trap, nests, feeders, perches, incubators, scales, etc. . . . .	1,200
Total . . . . .	5,277

<i>(3) Vocational Training School, Anklesvar, District Broach—</i>	
(1) Livestock—Purchase of Foundation Stock . . . . .	455
(2) Housing yards, etc., etc. . . . .	3,600
(3) Equipment, trap, nests, feeders, perches, incubators, scales, etc. . . . .	1,200
Total . . . . .	5,255

Thus the estimated grand total Capital Expenditure will arrive at —

	Rs.
(1) . . . . .	11,491
(2) . . . . .	5,277
(3) . . . . .	5,255
Total . . . . .	22,023

*Capital Expenditure.*

Out of the estimated Capital Expenditure of Rs. 22,023, the Government of Bombay will provide for the following :—

	Rs.
2,000 Incubator House.	
2,653 Livestock—Foundation stock for the proposed three Stations.	
Total . . . . .	4,653

The net provision for Capital expenditure to be made by the Imperial Council of Agricultural Research would arrive at Rs. 17,370 (Rs. 22,023 minus Rs. 4,653).

**RECURRING EXPENDITURE.**

—	1st year.	2nd year.	3rd year.	4th year.	5th year.
<i>Staff.</i>	Rs.	Rs.	Rs.	Rs.	Rs.
(1) At Government Central Poultry Farm, Kirkee—					
Additional pay to the Manager, Rs. 25—5—50 . . . . .	300	360	420	480	540
One Assistan Manager on Rs. 35—5/2—60—4—100 . . . . .	420	420	480	480	540
Two labourers at Rs. 20 each p. m. . . . .	480	480	480	480	480
Two women for cleaning at Rs. 10 each p. m. . . . .	240	240	240	240	240
Total . . . . .	1,440	1,500	1,620	1,680	1,800

	1st year.	2nd year.	3rd year.	4th year.	5th year.
	Rs.	Rs.	Rs.	Rs.	Rs.
(2) At American Mission Vocational School and Rural Centre, Vadala Mission, District Ahmednagar—					
One Assistant Manager at Rs. 35—5/2—60—4—100 . . . . .	420	420	480	480	540
One Village Research and Investigating Officer at Rs. 35—5/2—60—4—100 . . . . .	420	420	480	480	540
One skilled labourer at Rs. 20 p.m.	240	240	240	240	240
Two women at Rs. 10 each p.m. for cleaning . . . . .	240	240	240	240	240
Total . . . . .	1,320	1,320	1,440	1,440	1,560
(3) At Vocational Training School, Anklesvar, District Broach—					
One Assistant Manager at Rs. 35—5/2—60—4—100 . . . . .	420	420	480	480	540
One Village Research and Investigating Officer at Rs. 35—5/2—60—4—100 . . . . .	420	420	480	480	540
One skilled labourer at Rs. 20 p.m.	240	240	240	240	240
Two women at Rs. 10 each p.m. for cleaning . . . . .	240	240	240	240	240
Total . . . . .	1,320	1,320	1,440	1,440	1,560
<i>Upkeep.</i>					
(1) Government Central Poultry Farm, Kirkee—					
Feeds and Feeding . . . . .	800	1,000	1,000	1,000	1,000
Miscellaneous oil, medicines, etc. . . . .	200	200	200	200	200
Postage, records, forms, etc. . . . .	90	90	90	90	90
Total . . . . .	1,090	1,290	1,290	1,290	1,290

	1st year.	2nd year.	3rd year.	4th year.	5th year.
	Rs.	Rs.	Rs.	Rs.	Rs.
<i>Upkeep—contd.</i>					
(2) At American Mission Vocational School and Rural Centre, Vadala Mission, District Ahmednagar—					
Feeds and Feeding . . . . .	480	640	640	640	640
Miscellaneous oil, medicines, etc. . . . .	200	200	200	200	200
Postage, records, forms, etc. . . . .	90	90	90	90	90
Total . . . . .	770	930	930	930	930
(3) Vocational Training School, Anklesvar, District Broach—					
Feeds and Feeding . . . . .	480	640	640	640	640
Miscellaneous oil, medicines, etc. . . . .	200	200	200	200	200
Postage, records, forms, etc. . . . .	90	90	90	90	90
Total . . . . .	770	930	930	930	930

Thus the grand total of Recurring Expenditure would arrive at—

	Rs.
1st year . . . . .	6,710
2nd year Rs. 7,290 plus Rs. 100 for replacing Indian stock . . . . .	7,390
3rd year Rs. 7,650 plus Rs. 100 for replacing Indian stock and Rs. 600 for bringing fresh blood . . . . .	8,350
4th year Rs. 7,710 plus Rs. 100 for replacing Indian stock . . . . .	7,810
5th year Rs. 8,070 plus Rs. 100 for replacing Indian stock and Rs. 600 for bringing fresh blood . . . . .	8,770
Grand Total . . . . .	39,030

Out of the estimated Recurring Expenditure of Rs. 39,030, the Government of Bombay will provide for the following :—

*Livestock—*

	Rs.
400 For replacing Indian stock ; and 1,200 For bringing fresh blood.	
Total . . . . .	1,600

The net provision for Recurring Expenditure to be made by the Imperial Council of Agricultural Research would arrive at Rs. 37,430 (Rs. 39,030 minus Rs. 1,600).

The probable Income of the Scheme would be as follows :—

## INCOME.

	1st year.	2nd year.	3rd year.	4th year.	5th year.
	Rs.	Rs.	Rs.	Rs.	Rs.
(1) Government Central Poultry Farm, Kirkee—					
50 laying hens for commercial egg farm at 10 dozen eggs per bird.					
500 dozen eggs at 0-8-0 per dozen	250	313	375	438	500
20 Country fowls at 5 dozen eggs each per annum at 0-6-0 per dozen.	38	48	57	67	76
(2) American Mission Vocational School and Rural Centre, Vadala Mission, District Ahmednagar—					
20 English hens at 10 dozen eggs per annum per bird at 0-6-0 per dozen. 200 dozen at 0-6-0 per dozen.	75	94	113	131	150
20 Country fowls at 5 dozen eggs per bird per annum at annas 4 per dozen.	25	31	38	44	50
(3) Vocational Training School, Anlesver, District Broach—					
20 English hens at 10 dozen eggs per annum per bird at as. 6 per dozen. 200 dozen at 0-6-0 per dozen.	75	94	113	131	150
20 Country fowls at 5 dozen eggs per bird per annum at as. 4 per dozen.	25	31	38	44	50
Total	488	611	734	855	976

Thus the total estimated Income for five years would amount to Rs. 3,664.

The income is based at a modest figure, taking into consideration the two stations which are away from large towns, and consequently there is a difficulty of finding a market.

Any excess income received over and above the estimated figure will be credited to the Imperial Council of Agricultural Research.

(Signed) E. J. BRUEN,  
Live-Stock Expert to Government, Poona.

DEPARTMENT OF AGRICULTURE

Form No. 1.

MONTHLY EGG RECORD SHEET.

*Month*

*Breed*

*Pen*

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total.	

DEPARTMENT OF AGRICULTURE.

Form No. 1.

MONTHLY EGG RECORD SHEET.

*Year*

*Breed*

*Pen*

No. of Hen.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Total.	Pre-vious Total.	Date of Start.	No. of Dam or Pen.	12 months' record.	Remarks

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**DEPARTMENT OF AGRICULTURE**  
**INCUBATOR RECORD**

---



DEPARTMENT OF AGRICULTURE.  
INCUBATOR RECORD.

No. of incubator:

Name of Incubator.

Name of Operator.

Date—Eggs placed in incubator:

No. of eggs.

Kind of eggs.

Date—Hatch due.

Day	x	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	x
Date																							
	a.m. p.m.																						a.m. p.m.
107°																							
106.5°																							
106°																							
106.5°																							
105°																							
104.5°																							
104°																							
103.5°																							
103°																							
102.5°																							
102°																							

101.5°

101°

100.5°

100°

99.5°

99

No. of eggs :

Total

Remarks.

Breed(s) :

Source or Strain :

From Pen(s) No. :

Mark(s) :

No. Infertile

%

No. Dead Germs

%

No. Dead in Shell

%

No. Chicks Hatched

%

Transferred from Incubator on date of

To Brooder(s)

Or sold to :

Incubator released from this hatch.

Report signed.

In charge of Incubator.

Used in Experiment No. :



Aver. Weight	.																					
No. Pullets	.																					
No. Cockrels	.																					
Misc.	.																					

\*Band Nos. of Dead Chicks.

Disposal of Chicks.

Used in Experiment No.

DEPARTMENT OF AGRICULTURE.

PEDIGREE CHICK RECORD.

*Key*  
 D. Extra Special. B—Blue. Culled C—Black.  
 Special R—Red. Sold S—Yellow. Kept—K.

Wing Band No.	Dam No.	Sire No.	Date of Hatch	Sex.	Grade Disp.	Adult No.	Wing Band No.	Dam No.	Sire No.	Date of Hatch	Sex	Grade Disp.	Adult No.	Wing Band No.	Dam No.	Sire No.	Date of Hatch	Sex.	Grade Disp.	Adult No.	

DEPARTMENT OF AGRICULTURE  
POULTRY FLOCK RECORD

<i>Breed</i>	<i>Month</i>	<i>Section</i>					<i>Exp. Period</i>			<i>Pen No.</i>		<i>Notes.</i>		
<i>Date,</i>	<i>Grain.</i>	<i>Mash</i>		<i>Shell.</i>	<i>Grit.</i>	<i>Green Food.</i>	<i>Eggs.</i>		<i>Dead.</i>	<i>Hospital.</i>			<i>Broody.</i>	
		<i>wet.</i>	<i>dry.</i>				<i>Broken.</i>	<i>Total.</i>		<i>Sent to</i>	<i>Re-turned.</i>		<i>Taken out,</i>	<i>Re-turned.</i>
Weigh back . . . .														
Total . . . . .														
Weigh back . . . .														
Total . . . . .														

DEPARTMENT OF AGRICULTURE  
POULTAY FLOCK RECORD

Breed                      Month                      Section                      Exp. Period                      Pen No.

Date.	Grain.	Mash		Shell.	Grit.	Green Food.	Eggs.		Dead.	Hospital		Broody.		Notes.
		wet.	dry.				Broken.	Total.		Sent to	Re-returned.	Taken out.	Re-returned.	
Weigh back . . . . .														
Total . . . . .														
Weigh back . . . . .														
Total . . . . .														

252

SUMMARY.

Total Eggs.

Food Consumption.— Grain —————  
Mash —————  
Shell —————  
Grit —————  
Green Food —————

DEPARTMENT OF AGRICULTURE

MATING RECORD

Date Mating made.....Year.....Variety.....Mating made by.....Pen No.

MALE.	Hen No.	No. Eggs.	Egg Weight.	Body Weight.	Mating No.	No. Eggs Set.	No. Inf.	No. Vig. Chicks.	% Fert.	% Total Hatch.	Remarks.
Leg Band No. . . . .											
Wing Band No. . . . .											
Male's Sire . . . . .											
Male's Sire's Body Weight . . . . .											
Male's Dam . . . . .											
Male's Dam's No. Eggs . . . . .											
Male's Dam's Egg Weight . . . . .											
Male's Dam's Body Weight . . . . .											
Out of Mating No. . . . .											
Description.											
Comb . . . . .											
Eye . . . . .											
Head . . . . .											



DEPARTMENT OF AGRICULTURE  
MATING RECORD

Date Mating made.....Year.....Variety.....Mating made by.....Pen No.

MALE.	Hen No.	No. Eggs.	Egg Weight.	Body Weight.	Mating No.	No. Eggs Set.	No. Inf.	No. Vig. Chicks.	% Fert.	% Total Hatch.	Remarks.
Back . . . . .											
Tail . . . . .											
Legs . . . . .											
Plumage . . . . .											
Vigour . . . . .											
Carriage . . . . .											
Reserve Males.											
Leg Band No. . . . .											
Wing Band No. . . . .											
Leg Band No. . . . .											
Wing Band No. . . . .											
		Male's Hatching	Record	Totals.							

Remarks.

**DEPARTMENT OF AGRICULTURE**  
**MONTHLY SUMMARY OF EXPERIMENTAL DATA**

House—

1      2      3      4      5      6      7      8      9      10

	1	2	3	4	5	6	7	8	9	10
Percentage production . . . . .										
Eggs per bird . . . . .										
Total Production . . . . .										
Income . . . . .										
Feed cost . . . . .										
Margin over Feed cost . . . . .										
Food Consumption per bird . . . . .										
Mortality . . . . .										
Average Weight of birds . . . . .										
Average Weight of eggs . . . . .										
1st Grade eggs . . . . .										
2nd Grade eggs . . . . .										

## APPENDIX XXXV.

NOTE DATED THE 4TH FEBRUARY 1935 BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT NO. 40.—APPLICATION FROM THE UNITED PROVINCES POULTRY ASSOCIATION, LUCKNOW, FOR A GRANT OF RS. 32,570 (RS. 5,784 NON-RECURRING AND RS. 26,786 RECURRING) SPREAD OVER A PERIOD OF THREE YEARS FOR RESEARCH INTO THE PRESERVATION AND HANDLING OF EGGS AND POULTRY PRIOR TO THEIR DISPOSAL IN THE MARKET.

Attention is invited to the attached letter No. 1110-I/XVIII-652 dated the 20th December 1934, from the Government of the United Provinces forwarding a scheme on the subject mentioned above (Annexure I).

2. As members of the Board are aware, the United Provinces Poultry Association submitted a scheme in the first instance for investigation to develop egg and poultry marketing on a co-operative basis. This scheme which was considered by the Board at its meeting held in February, 1934, was returned to the Association for revision on the ground that the Association should deal only with the investigation of the best methods of storage, preservation and disposal of poultry products in various ways, e.g., in the form of dry powder, and that the details of accommodation and facilities which would be available and required for carrying on the work should be stated.

3. The scheme was revised on those lines and was considered by the Cattle Breeding Committee of the Council in the first instance. The Committee was of the opinion (Annexure II) that research work was necessary to study the best methods of testing, grading, packing for transport of eggs under Indian conditions and that work should be continued on the preparation of egg-powder and egg pulp. In the absence of a properly established Poultry Institute, work on experimental manufacture of egg-powder and egg pulp should be carried on in collaboration with the Harcourt Butler Technological Institute, Cawnpore, but it was considered that in order to carry out experimentation on an adequate scale it would be necessary to make provision for a regular supply of sterile eggs, the freshness of which could be guaranteed. The Committee also required information as to the resources and staff available for carrying out this work. In the circumstances the Committee recommended that a fresh scheme should be drawn up by the Director of Veterinary Services, United Provinces for the United Provinces Poultry Association to work in collaboration with the Harcourt Butler Technological Institute to deal with the problems connected with the collection, storing and disposal of eggs and powder which would not be part of the work of the marketing staff. The Advisory Board accepted the above recommendation (Annexure III).

4. The scheme now received has been drawn up on the lines of the recommendation of the Cattle Breeding Committee and will be considered by that Committee in the first instance. Its report will be submitted to the Advisory Board for consideration.

## ANNEXURE I.

COPY OF A LETTER No. 1110-I/XVIII-652, DATED THE 20TH DECEMBER 1934, FROM P. M. KHAREGAT, ESQ., I.C.S., M.L.C., SECRETARY TO GOVERNMENT, UNITED PROVINCES, INDUSTRIES DEPARTMENT, LUCKNOW, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI.

SUBJECT :—*Revised application from the United Provinces Poultry Association, Lucknow, for a grant of Rs. 32,570 spread over three years for research into the preservation and handling of eggs and poultry prior to their disposal in the market.*

With reference to your letter No. F.7-(4)/34/Vety. dated November 9, 1934, I am directed to forward a revised application (with 200 spare copies) from the United Provinces Poultry Association, Lucknow, for a grant of Rs. 32,570; (Rs. 5,784, non-recurring and Rs. 26,786 recurring spread over a period of three years) for a fresh scheme for research into the preservation and handling of eggs and poultry prior to their disposal in the market, and to state that it has been recommended by the United Provinces Agricultural Research Committee at its meeting held on November 16, 1934. A copy of the Committee's resolution on the subject is enclosed.

2. I am to request that the scheme may please be placed before the next meeting of the Advisory Board of the Imperial Council.

## ENCLOSURE TO ANNEXURE I.

*Copy of resolution No. 7 passed at the 11th meeting of the U. P. Agricultural Research Committee, held at the Council House, Lucknow, on November 16, 1934 at 11 a.m.*

*Agenda.*

7. Consideration of an application from the U. P. Poultry Association, Lucknow, to the Imperial Council of Agricultural Research for a grant of Rs. 33,770 (Non-recurring Rs. 5,784 and recurring Rs. 27,986) spread over 3 years for research into the Preservation and handling of eggs and poultry prior to their disposal in the market.

*Resolutions.*

7. Resolved that the scheme as amended to Rs. 32,570 be recommended to the Imperial Council of Agricultural Research.

*Revised scheme for research into the preservation and handling of eggs and poultry prior to their disposal in the market for a grant of Rs. 32,570 spread over a period of three years.*

A scheme for the purpose stated above was submitted to the Imperial Council of Agricultural Research by the United Provinces Poultry Association in September 1934, but the Advisory Board of the Imperial Council, in view of the fact that the position had altered owing to the creation of marketing officers, who would deal with most of the work for which the previous scheme was drawn up, decided at its meeting held in Simla on September 6, 1934, that the Director, Civil Veterinary Department, United Provinces, should be asked to draw up a fresh scheme for the United Provinces Poultry Association to work in collaboration with the Harcourt Butler Technological Institute, Cawnpore. A scheme is now being submitted embracing a programme for experiments on testing, grading, preserving, and packing eggs under Indian conditions and their methods of disposal in forms other than in shell especially the manufacture of dry powder, experiments on which should be continued at the above mentioned institute.

The production of eggs has increased 75 per cent. during the past 10 years particularly in the United Provinces. During that time a great deal has been done in the province to improve the general standard of poultry and eggs not only by the Poultry Association and its members but also through other sources, chiefly Mr. Slater of Etah district. This improvement in the quality of eggs has led to a rise in prices and a more general demand for this commodity not only in cities but in rural areas as well. This demand is not being met, partly owing to bad marketing but chiefly to the failure to preserve the surplus stock in time of plenty.

The value of conservation of perishable surplus produce for consumption in times of scarcity is recognized all over the world, as it is by conservation that a uniform supply of eggs is made available throughout the year, prices are stabilized, and the producer and consumer benefit alike.

Perhaps in no other country is there a greater need for conservation of eggs and other perishable commodities than India. The scattered areas of production, their inaccessibility, absence of proper communication and slow method of transport in rural areas offer additional stimulus, also the months of the heaviest production are those when seasonal changes are taking place, viz., March to June a period when the life of an egg in its fresh condition is extremely short. We are all familiar with the difficulties of obtaining fresh supplies during these months.

The position of the poultry keeper must also be considered and the anxious times he has owing to his inability to preserve his commodity and market it in a saleable condition.

When the work of marketing these commodities is undertaken the value of this scheme for preservation will be realized and appreciated by the marketing staff as its success will depend on the thoroughness with which these perishable commodities are preserved and the condition in which they are put on the market.

Preservation is intimately bound up with poultry keeping and marketing of all poultry products and the object of this scheme is to carry out investigation on the best way to preserve these commodities and to ascertain the relative value of cold storage, pickling and other forms of preservation.

With a view to overcoming these difficulties it is intended to study the following problems:

- (a) Study of the best method of grading eggs by interior quality determined by candling; weight; size; and colour.
- (b) Investigation into the method of preserving eggs by cold storage, pickling and other methods.
- (c) Investigation into the method of storing eggs.
- (d) The best method of packing and transporting eggs.
- (e) The best method of disposal of eggs other than in shell.

Item (e).—It is intended that investigation on this work will be carried out at the Harcourt Butler Technological Institute, Cawnpore and the work in connexion with the rest of the investigation will be done in close co-ordination with that institute at the United Provinces Poultry Association. The necessary materials for experimental purposes (eggs and table fowls) will be supplied by the United Provinces Poultry Association by maintaining a small flock of fowls on the farm for this purpose.

The experiment at the Harcourt Butler Technological Institute will be one on a small scale and will be confined to the production of 2 lbs. of egg powder per day which will require the use of 100 infertile eggs. From enquiries so far made it appears that experimentation on a large scale is not feasible until such time as the extent of the demand for egg products in India and abroad has been fully explored.

Land and buildings will be provided by the United Provinces Poultry Association and the service of a member of their staff will be placed at the disposal of the Director, Civil Veterinary Department, United Provinces, who will supervise and control this work.

The returns from the sale of eggs and egg produce while the scheme is in operation and the stocks at the end will be credited to the I. C. A. R.

Two statements giving details of the cost of the scheme are enclosed.

#### NON-RECURRING.

##### 1.—Purchase of stock—

<i>Stock—</i>	Rs.
Cockerels 4 at Rs. 15 each . . . . .	60
Hens 20 at Rs. 15 each . . . . .	300
Laying Pullets 150 at Rs. 15 each . . . . .	2,250
Broody Hens 20 at Re. 1 each . . . . .	20

## 2.—Housing accommodation—

<i>Houses and runs for adult birds—</i>	Rs.
Houses and runs for pullets . . . . .	180
Houses and runs for breeding pens . . . . .	}
(Housing accommodation for spare cockerels and chicks to be provided for by the United Provinces Poultry Association) . . . . .	168

## 3.—Appliances, etc.—

Hatching and rearing. { One Incubator (silver hen 50 egg capacity) . . . . .	65
{ Two Foster-mothers 150 chicks capacity at Rs. 75 . . . . .	150
Feeding and watering. { Four tin canisters, 4 <i>kundas</i> , 4 earthenware tubs, 12 each of wooden feeding troughs and mash hoppers. . . . .	150
Egg cases 2 at Rs. 25 each for storing hatching eggs . . . . .	50
Sprayer 1 . . . . .	30
Wall Thermometers 2 at Rs. 2 each . . . . .	4
Miscellaneous contingencies . . . . .	200

## 4.—Materials and appliances for candling, grading, preserving, storing and packing eggs for transport and for experiments on table fowls—

Egg testing and grading machine 1 . . . . .	200
Pickling tank—capacity 300 eggs . . . . .	25
Egg testing lamp 1 . . . . .	3
Egg weighing scale 1 . . . . .	5
Egg stamp . . . . .	7
Caponising set . . . . .	17

## 5.—Cost of the experiment at the Harcourt Butler Technological Institute, Cawnpore—

	Rs.
(Putting up a small plant for the manufacture of dried egg powder estimated by the Industrial Chemist to Government, United Provinces, Cawnpore) . . . . .	300
Refrigerator . . . . .	1,000
6.—Office equipment . . . . .	600

Total, Non-recurring . . . . .	5,784
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## RECURRING.

Particulars.	First year.	Second year.	Third year.	Total for three years.
One egg experimental officer, at Rs. 200—15—230.	Rs. 2,400	Rs. 2,580	Rs. 2,760	Rs. 7,740
One clerk at Rs. 40—2—44 . . . . .	480	504	528	1,512
One peon at Rs. 12 per mensem . . . . .	144	144	144	432
Two poultrymen at Rs. 10 per mensem . . . . .	240	240	240	720
One waterman at Rs. 12 per mensem . . . . .	144	144	144	432
Feeding cost for adult birds and young stock.	1,000	1,200	1,200	3,400
Running of Incubators and Foster-mothers.	100	100	100	300
Medicines, etc. . . . .	50	50	50	150
Repairs to farm houses and runs . . . . .	..	100	150	250
Materials for experimental purposes (containers and other packing material).	300	300	300	900
Preservatives (water glass, oil, and waxes, etc.).	1,200	1,200	1,200	3,600
Contingencies, stamps and stationery . . . . .	100	200	300	600
Miscellaneous . . . . .	200	200	200	600
Books and periodicals . . . . .	50	50	50	150
Travelling allowance . . . . .	800	800	800	2,400
Cost of experiment at the Harcourt Butler Technological Institute, Cawnpore, at Rs. 100 per mensem.	1,200	1,200	1,200	3,600
Labour Rs. 20 per mensem . . . . .	..	..	..	..
Fuel Rs. 10 per mensem . . . . .	..	..	..	..
Cost of transport of eggs from the Lucknow Farm to the Harcourt Butler Technological Institute, Cawnpore, Rs. 30 per mensem.	..	..	..	..
Contingencies including packing materials and containers, etc., Rs. 40 per mensem.	..	..	..	..
Total, Recurring . . . . .	8,408	9,012	9,366	26,786
Total, Non-recurring . . . . .	5,784	..	..	5,784
GRAND TOTAL . . . . .	14,192	9,012	9,366	32,570

## ANNEXURE II.

## EXTRACT FROM THE REPORT OF THE SECOND MEETING OF THE STANDING CATTLE BREEDING COMMITTEE HELD ON THE 3RD SEPTEMBER 1934.

Item No. 4—United Provinces Poultry Scheme.—In the discussion on this scheme it was pointed out that 3 of the items of work suggested by the Secretary, United Provinces Poultry Association, in his letter to the Director, Civil Veterinary Department, United Provinces, No. E. S. 1069, dated 6th August 1934, were essentially work which would be done by the Marketing organisation. It was agreed however that research work was necessary to study the best methods of testing, grading, packing for transport of eggs under Indian conditions and that work should be continued on the preparation of egg-powder and egg pulp. It was agreed that in the absence of a properly established Poultry Institute, work on experimental manufacture of egg-powder and egg pulp should be carried on in collaboration with the Harcourt Butler Technological Institute, Cawnpore, as at present, but it was considered that in order to carry out experimentation on an adequate scale it would be necessary to make provision for regular supply of sterile eggs, the freshness of which could be guaranteed. Further information was also necessary as to the resources and staff available for carrying out this work. In view of the above it was proposed that a fresh scheme should be prepared by the Director of Veterinary Services for the United Provinces Poultry Association to work in collaboration with the Harcourt Butler Technological Institute to deal with the problems connected with the collection, storing and disposal of eggs and powder which would not be part of the work of the Marketing Staff.

## ANNEXURE III.

## EXTRACT FROM THE PROCEEDINGS OF THE MEETING OF THE ADVISORY BOARD HELD ON THE 6TH SEPTEMBER 1934.

6. *Application from the United Provinces Poultry Association, Lucknow, for a grant of Rs. 15,864 spread over three years for a scheme to investigate the preparation of eggs for marketing and other methods of disposal (Subject No. 25 of the Agenda).*

Colonel Olver introduced the report of the Cattle Breeding Committee on this subject and said that the scheme was considered by a sub-committee of the Board and the Board in February 1934 with the result that it was returned to the United Provinces Poultry Association for revision. Since the revised scheme was received the position had altered by the institution of a Marketing Section of the Council. The Marketing Section would deal with a greater portion of the scheme. The Committee therefore recommended that a fresh scheme should be prepared by the Director of Veterinary Services, United Provinces, for the Poultry Association to work in collaboration with the Harcourt Butler Technological Institute to deal with the problems connected with the collection, storing and disposal of eggs and powder which would not be part of the work of the Marketing Staff. Mr. Nurul Islam accepted that the scheme did contain some points connected with the marketing of eggs but he wanted clearer instructions for the preparation of a fresh scheme than were given by the Committee. He then pointed out that the Association could not supply sterile eggs free of cost and this was why a provision of Rs. 500 per annum had been made in the scheme. Mr. Nurul Islam then moved that the following portion of the Committee's report be deleted:—

"Item No. 4—United Provinces Poultry Scheme, page 1 of the Report, lines 7 to 9. Research work was necessary to study the best methods of testing, grading, packing and transporting eggs under Indian conditions and".

Mr. Egan said that it would be necessary to provide material for research at the Harcourt Butler Technological Institute at Cawnpore. The Institute could not supply sterile eggs and unless a small grant was sanctioned for the purpose it was not possible for the Institute to carry on the research. Mr. Bruen proposed that the words "packing and transporting eggs" be changed into "packing for transport of eggs". He also added that the United Provinces Poultry Association should supply the sterile eggs by naving poultry on their farm and not purchase them. The scheme should be prepared in the best method for storing and packing eggs. In replying to Mr. Nurul Islam's objections Colonel Olver explained that what the Committee proposed to cut out was the work which dealt with marketing aspects of the scheme as it was considered that this work would be done by the marketing staff. On the other hand it was definitely agreed that research work was necessary to study the best methods of testing, grading,



packing eggs for transportation under Indian conditions and that work should be continued on the preparation of egg-powder and egg pulp. To carry on this work it was necessary to have a supply of sterile eggs which were known to be fresh. Mr. Nurul Islam had stated that he could not supply them from the Association and it was therefore necessary to make provision for this in the scheme. The Committee had also recommended to omit that portion of the scheme which involve travelling about the country. Mr. Quirke agreed with Colonel Olver. Mr. Livingstone said that there were four points in the scheme, viz.

- (a) Study of indigenous methods of producing eggs;
- (b) Study of the question of organised collection;
- (c) Study of methods of testing, grading and standardisation; and
- (d) Study of the work done by the Association in regard to storage, preservation and packing of eggs. The first three concerned the marketing staff and the Committee had therefore recommended that they be left out of the scheme. The fourth point was for the Association to take up and therefore the Committee had recommended that a fresh scheme be prepared in the light of the remarks offered by it.

The Chairman then summed up the discussion on the subject and put the amendment of Mr. Nurul Islam before the Board. The amendment fell through for want of a seconder. The amendment of Mr. Bruen was accepted by the Board. The report of the Standing Cattle Breeding Committee on the subject was then adopted by the Board.

## APPENDIX XXXVI.

NOTE DATED THE 22ND FEBRUARY 1935 BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT No. 49.—PROPOSAL FOR THE ESTABLISHMENT OF A CENTRAL ANIMAL NUTRITION INSTITUTE.

The subject mentioned above was discussed by the Standing Animal Nutrition Committee of the Imperial Council of Agricultural Research at its meeting held on the 20th and 21st February 1935 and an extract from its proceedings is attached herewith (Annexure).

2. The subject is for the consideration of the Board.

## ANNEXURE.

EXTRACT FROM THE PROCEEDINGS OF THE MEETING OF THE STANDING ANIMAL NUTRITION COMMITTEE OF THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH HELD ON THE 20TH, 21ST AND 22ND FEBRUARY 1935.

The following were present:—

1. Col. A. Olver.
2. Dr. F. J. Warth.
3. Dr. P. E. Lander.
4. Dr. K. C. Sen.
5. Rao Bahadur B. Viswanath.
6. Mr. J. R. Haddow.
7. Mr. F. Ware.
8. Mr. C. H. Parr.

Rai Bahadur Malik Charan Das, Secretary.

*To discuss the establishment of a Central Animal Nutrition Institute for all India.*

It was agreed that consideration of the different schemes of research in Animal Nutrition which have been submitted to this Committee could not be adequately assessed until the functions and location of the proposed Central Animal Nutrition Institute have been decided upon. It was unanimously agreed by the Committee that the main functions of the Central Institute should be defined as the study of nutrition in relation to the maintenance of the health, normal growth and productive capacity of animals in India. It was also agreed that the following should be the main lines of work to be taken up at this institute:—

1. Analysis of the important foodstuffs of India.
2. Analysis of the pastures of typical grazing areas.
3. Digestibility and utilization experiments on foodstuffs of all India importance.
4. The physiological significance of the inter-relation of foodstuffs.
5. Correlation of the nutrition work done at the central Institute and at provincial centres.
6. Diet in relation to growth.
7. Diet in relation to milk production.
8. Diet in relation to work.
9. Diet in relation to wool production.
10. Diet in relation to the production of hides and skins.
11. Diet in relation to breeding problems.
12. Mineral requirements.
13. Vitamin requirements.

14. Collaboration with Agriculture on factors affecting the composition of food stuffs.
15. Collaboration with Muktesar regarding the influence of nutrition on susceptibility to disease.
16. Basal metabolism.

2. As to the location of the Institute the claims of Bangalore, Dehra Dun, Izatnagar and Delhi were considered in detail and it was eventually unanimously decided that taking all things into consideration Izatnagar was the most suitable. The reasons for arriving at this decision were:—

- (i) that, as there was already a sub-station of Muktesar dealing with Animal Husbandry matters in existence at Izatnagar with 750 acres of well cultivated land, and other facilities available and in view of the fact that it was proposed to establish a Poultry Research Institute there, it would greatly facilitate animal husbandry research on nutrition and on the effects of diet on health and development if the Central Animal Nutrition Institute were established at Izatnagar.
- (ii) Two or three hundred acres of well cultivated land could be handed over for the development of such an Institute under the control of the Director.
- (iii) A regular supply of animals particularly suitable for nutrition research would be available from the Muktesar Institute at a very cheap rate.
- (iv) Electric light and power and water will soon be available at the site.
- (v) The land would be fairly representative of the plains condition and there was ample room for extension if required.
- (vi) The climate was less trying than, for example, at Delhi and it was ascertained that small animals such as rabbits and Guinea Pigs for experimental purposes bred and developed well at Izatnagar.
- (vii) The Institute would have easy access to the Muktesar Library which is probably the most complete in the country on the animal husbandry subjects, including nutrition. The Institute at Izatnagar is within easy distance of the town of Bareilly in which residential accommodation could be obtained if quarters were not available.
- (viii) Izatnagar is centrally placed and has also good railway communications with all parts of India.

3. It was agreed that the Nutrition Institute should deal primarily with the effect of nutrition on animals in health and that the Muktesar Institute should deal with disease conditions arising from faulty nutrition whenever they arose. It was considered that the work of the Institute should be divided into four sections, namely, Physiological Section, Bio-chemical Section, Analytical Section and Pathological Section. It was recommended that a Veterinary Pathologist should be a member of the staff of the Institute.

In the case of Bangalore it was agreed by all that it was not possible to develop a satisfactory institution there, largely because of its isolation from cognate research and the possibility of obtaining room for expansion of the Dairy Institute and for the establishment of a separate Nutrition Research Institute. In the case of Dehra Dun the land would have to be purchased and considerable expense will be involved in establishing a farm and in providing the necessary lighting and other facilities. In the case of Delhi extra land would have to be obtained and cost of providing the necessary accommodation facilities will be considerably greater and the climate would not be so good. Moreover, the facilities for collaboration with other workers on animal husbandry subjects would be far less than at Izatnagar and the library would not be so well supplied with publications on these subjects. It was agreed that the nutrition institute should be called the 'Imperial Institute of Animal Nutrition' and that the Physiological Chemist should be asked to prepare a scheme for submission to the Education, Health and Lands Department through the Director, Imperial Institute of Agricultural Research, who was present at the meeting and agreed with these proposals.

A. OLVER.

DELHI;

The 21st February 1935.

## APPENDIX XXXVII.

NOTE DATED THE 10TH FEBRUARY 1935 BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT NO. 47.—APPLICATION FROM THE GOVERNMENT OF THE UNITED PROVINCES, FOR A GRANT OF RS. 1,96,720 SPREAD OVER 5 YEARS FOR RESEARCH INTO THE FEEDING OF CATTLE AT THE DEPARTMENTAL FARMS.

Attention is invited to the attached copy of a scheme (Annexure) received from the United Provinces Government for research into the feeding of cattle at the departmental farms. The scheme involves a total expenditure of Rs. 2,82,220. The council is asked to meet Rs. 1,96,720 (Rs. 19,000 non-recurring and Rs. 1,77,720 recurring) spread over 5 years. The United Provinces Government is prepared to meet Rs. 28,000 non-recurring and Rs. 57,000 recurring. The scheme has been recommended by the Provincial Research Committee and will first be considered by the Animal Nutrition Committee and the report of the Committee will be circulated to the Board in due course.

## ANNEXURE.

*An application from the United Provinces Government to the Imperial Council of Agricultural Research for a grant of Rs. 1,96,720 (non-recurring Rs. 19,000 and recurring Rs. 1,77,720) spread over five years for a scheme of practical research into the feeding of cattle at the departmental farms.*

## INTRODUCTION.

The days when large tracts of grazing areas at nominal costs were at the disposal of cattle owners for the maintenance of their cattle are over. Pressure of cultivation has curtailed these, and now, except in tracts where cultivation is largely uneconomic, the grazing areas, which were formerly maintaining a large cattle population, now barely provide a sufficiency for their maintenance, even for the pasture growing period during the monsoon, which barely exceeds three months of the year. Efficiency in cattle therefore, can be maintained only by extensive stall feeding and feeding costs have become by far the biggest item in their maintenance, no matter the purpose for which they are maintained.

The importance of cattle in supplying the motive power in Indian Agriculture and as a source of milk, which should form such an important part in the diet of a people largely vegetarian, does not require to be stressed to emphasise the need for investigation designed to ascertain methods of maintenance which will increase their efficiency at a lowering of cost in the biggest item of expense namely feeding.

The investigation will not be limited to enquiry into methods of stall feeding, but to the utilization of grazing areas alone and in combination with stall feeding and to methods of increasing their utility and productiveness.

The United Provinces Government can put at the disposal of the scheme four cattle breeding farms situated in different parts of the provinces representing four distinct sets of conditions:—

- (1) Madhurikund, Muttra.
- (2) Bharari, Jhansi.
- (3) Manjhra, Lakhimpur.
- (4) Hempur, Naini Tal district supplying conditions representative of a large portion of Northern India and can provide sufficient cattle from the large herds number nearly 3,000 head at the farms concerned. The enquiry can cover cattle of the following breeds:

- (1) Hissar.
- (2) Montgomery.
- (3) Kherigarh.
- (4) Murrah buffaloes.

- (5) The Allahabad Agricultural Institute proposes to associate itself with this work in regard to its dairy herd of Sindhi and cross breeds.

The farms provide several thousand acres of grazing which can be utilized in grazing experiments.

The results of the scheme will be applicable to an area much beyond limits of the United Provinces and will assist in checking the results obtained at other stations where similar investigations are now in progress.

The scheme proposes to investigate:—

I.—the cost of production of cultivated fodder crops and monsoon grasses. Methods of cultivation and treatments will be compared;

II.—comparative value of standard cultivated fodder crops and cultivated and pasture grasses in maintenance and production rations:

- In regard to (a) Working cattle.
- (b) Growing cattle.
- (c) Milking cattle.

The fodders will be examined in the various forms:

- (1) Dry as (a) Hay.
- (b) Straw after removal of grain.
- (2) Green.
- (3) Silage.

III.—Comparative value of common food grains, oil cakes, molasses, and other agricultural by-products in varying mixtures in production rations of all kinds of stock.

- (a) Working cattle, (b) Milking, (c) Growing stock.

IV.—Comparative feeding value of cultivated fodder crops and grasses under stall feeding and grazing conditions.

V.—Feeding value of monsoon and other grasses under various forms of treatment including rotational grazing.

VI.—Value of monsoon pasture for the production of (a) Hay, (b) Silage and the relative feeding value of each.

VII.—Value of mineral salts in rations of young, growing, milking and working stock (of the four different breeds) in relation to (a) different conditions of the four farms, (b) normal conditions of feeding of village herds in the four different tracts.

VIII.—Effect of mineral salts in regard to:

- (a) Fertility.
- (b) Weight, size and conditions of offspring at birth.
- (c) Resistance to parasitic infection.

IX.—Analyses of feeding stuffs.

A.—(a) At different stages of growth.

- (b) On the different farms in which trials are conducted.

B.—Milk analyses in trials with milk animals.

C.—Quantitative and qualitative analysis of excreta and urine of animals in various trials.

## APPENDIX.

### SYNOPSIS AND RESULTS OF PREVIOUS WORK DONE.

1. Nutrients required for growth with Indian food stuffs. Bangalore, 1925.

*Results.*—The computed requirements per lb. gain were found to be 1.907 and 2.696 therms for the younger and older groups respectively.

Comparing actual digestion with the digestion attained by mature bullocks on the same foods at Bangalore it was found that the carbohydrate digestion was 10 per cent. below normal in the younger groups, and 3.4 per cent. below normal in the older group.

requirements for Indian growing animals are higher than Armsby's figures.

Compared with the Wolff Lehmann standard the animals utilized the standard amount of protein and less than the standard amount of total nutrients. The bulk consumed by the older group was normal. The younger group consumed an abnormally large bulk.

*Reference.*—Memoirs of the Department of Agriculture in India, Volume VIII, No. 11, July 1926..

2. Nutrients required for milk production with Indian food stuffs, Bangalore, 1925.

*Results.*—Indian average computed requirement for milk production of digestible protein was 0.092 lbs. per lb. of milk. Savage's average is 0.067 lbs.

Difference due to:—

1. Indian roughages contain less than the average amount of digestible protein.
2. Indian cows digest slightly less protein even when allowance is made for the low digestibility of Indian roughage.

Therefore excess of protein digested and utilized per lb. of milk is less than the difference between these two figures. The actual requirements for milk production are in every case much lower than the computed figures.

*Reference.*—Memoirs of the Department of Agriculture in India, Volume VIII, No. 9, April, 1926.

3. Comparison of digestibility of rice straw and baled hay. Bangalore, 1926.

*Results.*—Dry rice straw was found to contain 49.97 per cent. of digestible organic matter, and there was little difference between Pusa and Bangalore results. The American figure is 42.14 per cent. The higher figure for Indian rice straw is due to better digestible capacity of Indian cattle for roughage and not due to American straw being less digestible as judged by chemical composition.

Dry baled hay was found to contain 48.24 per cent. of digestible organic matter. The digestibility of Indian hay is much inferior to the better class of American hay.

The test showed that the value of the two roughages is approximately equal. The nett energy values of rice straw and hay are 44 and 39.6 therms per 100 lbs. dry substance. They diverge considerably from accepted American values. It is concluded that the maintenance requirement of Indian bullocks must approximate closely to Armsby's average value of six therms per 1,000 lbs. live weight.

Rice straw induced diuresis due to high potash content of the straw.

*Reference.*—Memoirs of Department of Agriculture in India, Volume IX, No. 2. December 1926.

4. Determination of the consumption and digestion of rations by Scindi weaned calves with wheat bran, groundnut cake and broken rice to observe the relative effects of bulk, net energy and protein content upon consumption, digestion and growth, and using sorgham silage ad lib.

*Results.*—Great regularity was maintained in feeding of roughage and concentrates and both in relation to each other with wheat bran and groundnut cake mixture. There was a regular increase in roughage consumption with increasing live weight. With wheat bran alone the consumption of roughage hardly increased at all. There was also regularity in the amount of total dry matter consumed.

Sorgham silage produced very rapid growth and the high digestion attained was due to the quality of sorgham silage.

Protein digestion was proportional to the protein in ration. Calves which did not receive lime failed to grow rapidly.

*Reference.*—Memoirs of Department of Agriculture in India, Volume IX, No. 5, August, 1927.

5 Comparison of guinea grass and sorgham silage trials at Bangalore, 1926-27.

*Results*—Sorgham silage was eaten readily and was found in no way inferior to guinea grass.

*Reference.*—Report of Physiological Chemist, 1926-27.

6. Experiments to compare the values of typical Indian oil cakes for milk production. A series of tests at Bangalore, 1928-29.

Linseed and coconut cakes were compared both the country and expeller cakes being tested.

*Results.*—Linseed cake gave the highest yield. Expeller coconut cake came next. Country coconut cake produced slightly richer milk.

*Reference.*—Report of the Physiological Chemist, 1928-29.

7. Experiments on maturity of fodders at Bangalore, 1928-29; certain typical fodders were tested at different stages of maturity.

Results showed that the stage of maturity was a most vital factor in the nutritive value of fodders. With advancing maturity, the amount of digestible protein and crude fibre decreased steadily in every case.

*Reference.*—Report of the Physiological Chemist, 1928-29.

8. Preparation of silage from cereal straw at Bangalore, 1928-29.

Wheat straw silage was made with 250 parts water for 100 parts straw and the material well pressed. The silage was palatable and favourable. Digestion results were obtained. It proved to be good succulent feed in hot season for wheat tracts.

*Reference.*—Report of the Physiological Chemist, 1928-29.

9. The nutritive value of some typical Indian hays.

Digestion trials of 30 typical hays were carried out at Bangalore for three years, 1929-30.

*Results.*—Chemical composition of the 30 samples of different hays showed that the protein content ranged from 18.16 per cent. to 1.92 per cent. The wide variations were attributed mainly to:—

(a) Characteristics of species.

(b) Stage of maturity, i.e., with advancing maturity, the amount of digestible protein and starch equivalent value decreased steadily in every case.

High protein content was found associated with high soluble ash.

Digestion co-efficients were determined by feeding tests for each of the fodders. The digestibility of protein was high and increased fairly with the amount of protein content present.

*Reference.*—Memoirs of the Department of Agriculture in India, Volume XI, No. 4, August, 1930.

10. Experiments to study the function and nutritive value of gram husk. Trials conducted at Bangalore, 1929-30.

Gram husk mixed with groundnut cake was tested against groundnut cake alone.

*Results.*—Gram husk improved the ration in the same way as wheat bran. Both improved palatability and consistency of the ration and both caused an approximately equal increase in food consumption and live weight.

Digestion experiments showed that gram husk had an appreciable starch equivalent, but it was distinctly lower than that of wheat bran (being 4/5). Further gram husk provided no digestible protein and in this respect it differed widely from wheat bran.

Gram husk is moderately digestible food, but cannot be considered a concentrated food. It provided carbohydrate and no protein.

*Reference.*—Memoirs of Department of Agriculture in India, Volume XI, No. 5, August, 1930.

11. Relative merits of high and low silage feeding to milking cows at Bangalore in 1931.

*Results.*—Trial showed greater increase of live weight in case of high silage. The quantity and quality of milk was the same.

High silage feeding was not found economical. Sindhis and cross breeds consumed equal amount of dry matter per 1,000 lbs. live weight.

*Reference.*—Agriculture and Live Stock in India, Volume III, Part II, March, 1933.

12. Experiment on mineral assimilation from two typical fodders:—Ragi straw and mature hay.

Trial conducted at Bangalore in 1931-32, over three periods:—

(1) Fodder without mineral supplement.

(2) Fodder with supplement of calcium phosphate.

(3) Fodder with supplement of calcium phosphate and green food.

*Results.*—Ragi straw was found to be well provided with lime and phosphoric acid as appreciable assimilation took place in the first period. There was a very large assimilation of lime in second period, indicating the influence of phosphoric acid on lime assimilation.

Hay ration was found deficient in phosphoric acid.

*Reference.*—Indian Journal of Veterinary Science, and Animal Husbandry, Volume 11, Part IV, December, 1932.

13. Winter rationing of calves and comparison of coarse fodders like wheat straw, rice straw and sorgham hay.

Trial conducted at Karnal, 1925-26 and 1926-27.

Three roughages above were tested with a high and low concentrate allowance. The rate for the low and high allowances was 1 lb. and 1.5 lb. per lb live weight respectively.

*Results.*—Rice straw gave highest consumption and greatest increase in live weight. Good sorgham and rice straw were approximately equally consumed and appeared to have similar nutritive effects wheat straw was definitely below the others. High concentrates gave good results with rice straw and low concentrate with sorgham. The digestibility increased with the amount of protein. Rice straw and sorgham gave almost identical digestion results.

*Reference.*—Memoirs of Department of Agriculture in India, Volume X, No. 1, August 1928.

14. The nutritive value of spear grass fodder at Hossur, 1926, 1927 and 1928:—

- (1) Mature hay (80 per cent. spears removed).
- (2) Early cut spear grass hay.
- (3) Spear grass silage.

Six separate digestion data were obtained for each fodder. Both concentrates and coarse fodder, were fed in proportion to live weight and the coarse fodder being given in slight excess.

*Results.*—Silage and early cut hay were consumed more readily than mature hay even when limited amount were fed.

Protein was best digested in early cut hay ration, next the mature hay ration and last silage ration.

In carbohydrate digestion the silage ration was the best, the early cut hay next and the mature hay last. Silage and early cut hay were found superior to mature hay.

Silage was found good for cows receiving ample concentrates and early cut hay good for growing stock where economy was required.

Spear grass silage gave high nutritive value and increase in live weight. Both silage and early cut hay were good and produced similar growth.

*Reference.*—Memoirs of Department of Agriculture in India, Volume XI, No. 3, June, 1930.

15. Nutritive value of Kolukkattai grass dried artificially. Trial conducted at Hossur, 1932.

*Results.*—1.75 lbs. of artificially dried hay was found equal to 1 lb. in equal proportions of groundnut cake and wheat bran.

*Reference.*—Agricultural and Live Stock in India, Volume II, Part IV, July 1932.

16 Experiment on the feeding value of Prickly Pear carried out at Kirkee, 1913.

The pear used was the common variety. The spines were removed by burning. A mixture of 100 lbs. prickly pears and 6 lbs. cotton seed was fed to bullocks in exceptionally poor condition.

*Results.*—At first there was loss in live weight varying from 2 to 60 lbs. but subsequently steady gain was made to maximum which remained constant. The greatest gain was 70 lbs. The animals in the beginning were dull and emaciated with staring coats, but they rapidly improved and gained every appearance of good health.

This improved the condition of animals which were poor from semi-starvation. The average quantity consumed per head per day was 32 lbs. which worked out to 72 lbs. per 1,000 lbs. live weight.

*Reference.*—Bulletin No. 58 of 1913, Department of Agriculture, Bombay.



17. The value of green Barseem fodder as a substitute for Guvar (crushed) in concentrate mixture is given below :—

Trial conducted at Chharodi Farm in 1929-30.

Ration fed to an average Kankraj cow yielding 10 lbs. milk.

Wheat bran . . . . .	1½ lbs.
Til cake . . . . .	1½ lb.
Guvar . . . . .	1 lb.
Tur husks . . . . .	1 lb.

For roughages dry grazing and dry hay in sufficient quantities were given. 10 lbs. of Berseem substituted for 1 lb. Guvar.

*Results.*—Barseem feeding increased .86 lbs. milk and 0.16 per cent. milk fat and no increase or decrease in live weight.

This increase resulted from a nutritive ratio still wider in case of Berseem, e.g., 1.11 of Berseem compared to 1: 8.7 of Guvar ration.

*Reference.*—Annual experimental records of the Department of Agriculture, Bombay, 1929-30.

18. Some trials carried out for better milk production at Chhirodi, Bombay in 1930-31 showed that:

- (1) there is a tendency to overfeed cattle with bulky foods;
- (2) large quantities of succulent foods are injurious to cattle;
- (3) different types of food take a shorter or longer period to digest, hence if green and dry food are fed together the green food which is digested first, takes with it the dry food which has not been digested resulting in considerable waste;
- (4) if green fodder is fed that it should be fed a couple of hours after or before other meals.

*Reference.*—Annual experimental records, Department of Agriculture, Bombay, 1930-31.

19. Comparative feeding value of green Berseem fodder and maize silage in milk production.

Trial carried at Chhirodi in 1930-31.

*Results.*—An increase of 1 lb. 3 oz. milk was obtained on account of 30 lb. of green Berseem feeding. Berseem proved economical where facilities exist for bringing down the cost of growing it.

*Reference.*—Annual experimental records of the Department of Agriculture, Bombay, 1930-31.

20. Feed cost in milk production at Chhirodi, 1930-31.

For economical milk production animals must give over 4,000 lbs. of milk per lactation and that animals under 4,000 lbs. are not economical.

*Reference.*—Annual experimental records of the Department of Agriculture, Bombay, 1930-31.

21. A comparison of the value of cotton-seed hulls and Kadbi fed together with decorticated cotton-seed meal and safflower cake carried out at Poona, 1913.

Cotton hulls were found to be equal in feeding value to dry Kadbi, weight for weight. The most economical to feed depended on the price.

*Reference.*—Proceedings of the Agricultural Conference, Poona, 1913.

22. Comparative value of green Nilwa Jowar and green maize and its effect on milk yield.

Trial at Poona, 1929-30.

The fodder was fed ad lib and the concentrate at the rate of 5 lbs. per 10 lbs. milk.

*Results.*—Maize was consumed by 8.7 per cent. more than Green Nilwa and yielded 6 per cent. more milk and fat per cent. decreased.

*Reference.*—Annual experimental records of the Agricultural Department, Bombay, 1929-30.

23. Comparative feeding values of American cotton-seed and Deai cottonseed and to test the belief that all American cotton-seeds with hairy seed coats tend to choke the animals.

Trial at Lyallpur, Punjab in 1928-29.

*Results.*—American cotton-seed was found richer in fat and protein and that the albuminoid ratios of the American cotton-seed were superior to Desi seed. Further animals never choked while eating American seeds.

*Reference.*—Report of Department of Agriculture, Punjab, 1928-29.

24. Trials to ascertain the digestibility co-efficients and food values of green maize silage, green guara and oat silage, conducted at Lyallpur, Punjab, 1928-29.

*Results.*—All were found to be maintenance rations. The ensilage material had a higher food value and was better digested than hay.

*Reference.*—Report of Department of Agriculture, Punjab, 1928-29.

25. Nutritive value of six grass hays from Military farms in comparison with wheat bhusa.

Trial conducted at Lyallpur, Punjab, in 1929-30.

*Results.*—Chemical composition and nutritive value showed very wide variations, which were due to:—

- (1) Variations in the composition of the grasses themselves.
- (2) Stages of maturity.

These hays required 1 to 1.5 lbs. of wheat bran to become maintenance ration. Wheat bhusa was not a maintenance ration and required from 1 to 1.5 lbs. wheat bran to equal a maintenance ration.

*Reference.*—Indian Journal of Veterinary Science and Animal Husbandry, Volume 11, Part II, June, 1932.

The estimated cost of the scheme is as follows:—

*Details of non-recurring expenditure.*

PROVISION TO BE MADE BY THE UNITED PROVINCES GOVERNMENT.		PROVISION TO BE MADE BY THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.	
<i>Buildings—</i>		<i>Equipment—</i>	
	Rs.		Rs.
1 quarter for Research Assistant (at Bharari farm).	5,000	Oil gas plant (Bharari)	7,000
4 quarters for Assistant Research Assistants (one at each farm).	8,000	4 platform weighing machines (1 at each farm).	6,000
1 clerk	500	Office furniture, typewriter, etc.	800
1 mechanic at the Bharari farm	500	Laboratory equipment	8,000
25 servants quarters—		General apparatus	700
5 at Manjhra	6,000	General chemicals	500
7 at Madhurikund		Laboratory fittings	1,000
5 at Hempur			
8 at Bharari			
Laboratory, Bharari	8,000		
<b>Total</b>	<b>28,000</b>	<b>Total</b>	<b>19,000</b>
<b>GRAND TOTAL</b>		<b>47,000.</b>	

**DETAILS OF RECURRING EXPENDITURE.**

Provision to be made by the United Provinces Government.

Provision to be made by the Imperial Council of Agricultural Research

Item.	1st year	2nd year	3rd year	4th year	5th year	Total of 5 years	Item.	1st year	2nd year	3rd year	4th year	5th year	Total of 5 years
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
							<i>1.—Pay of Officers.</i>						
							1 Research Officer on Rs. 300—30—600 at Bharari farm.	3,600	3,600	4,320	4,680	5,040	21,600
							<i>2.—Pay of Establishment.</i>						
							4 Research Assistants on Rs. 150—10—200 one at each cattle farm.	7,200	7,680	8,160	8,640	9,120	40,800
							1 Chemical Assistant Rs. 150—10—200.	1,800	1,920	2,040	2,160	2,280	10,200
							1 Clerk on Rs. 40 at Bharari farm.	480	480	480	480	480	2,400
							1 Mechanic on Rs. 40 at Bharari farm.	480	480	480	480	480	2,400
							4 Literate mates on Rs. 20	960	960	960	960	960	4,800
							1 laboratory attendant on Rs. 15—1—20 at Bharari farm.	180	192	204	216	228	1,020
							25 Casual labourers on Rs. 14 each.	4,200	4,200	4,200	4,200	4,200	21,000
							<i>3.—Allowances.</i>						
							Travelling allowance	3,200	3,200	3,200	3,200	3,200	16,000
Contingent charges	8,500	8,500	8,500	8,500	8,500	17,500	4 Contingent charges	3,500	3,500	3,500	3,500	3,500	17,500
Feeds and Fodder	8,000	8,000	8,000	8,000	8,000	40,000	5 Feeds and fodder	8,000	8,000	8,000	8,000	8,000	40,000
<b>Total</b>	<b>11,500</b>	<b>11,500</b>	<b>11,500</b>	<b>11,500</b>	<b>11,500</b>	<b>57,500</b>	<b>Total</b>	<b>33,600</b>	<b>34,672</b>	<b>35,644</b>	<b>36,516</b>	<b>37,488</b>	<b>1,77,720</b>

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Abstract of the total cost of the schemes for five years is given below :—

	To be provided by the United Provinces Government.		To be provided by the Imperial Council of Agricultural Research.		Total.
	Rs.		Rs.		
Non-recurring	28,000		19,000		47,000
Recurring	57,500		1,77,720		2,35,220
<b>Total</b>	<b>85,500</b>		<b>1,96,720</b>		<b>2,82,220</b>

The item of Rs. 3,500 represents extra contingent charges to be provided by the Imperial Council of Agricultural Research to meet extra contingencies necessitated by the Research scheme. In providing the facilities which the cattle farms will put at the disposal of the scheme the United Provinces Government will be contributing a very much larger sum than this, but an equal amount is provided for in the estimate.

The item of Rs. 8,000 feeds, etc., represents extra feeds, grains, fodders, etc., which will be required in the several investigations which will be undertaken and which are not ordinarily required in the routine management of the farms. The farms however will put at the disposal of the scheme the feeds and fodders normally used in routine management. A similar amount of Rs. 8,000 has, therefore, been provided for to represent this contribution of the United Provinces Government to the scheme.

The item of Rs. 4,200 for labour represents expenditure which will be incurred in providing extra labour required for carrying out Research work at each of the four cattle breeding farms.

The Research Officer will be incharge of all investigations under the Deputy Director. His headquarters will be at the Bharari farm, and he will be in charge of the laboratory and the research work undertaken there. He will have one Assistant and will supervise the work of the other assistants at each of the other three cattle breeding farms.

## APPENDIX XXXVII-A.

PROCEEDINGS OF THE MEETING OF THE STANDING ANIMAL NUTRITION COMMITTEE OF THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH HELD ON THE 20TH, 21ST AND 22ND FEBRUARY 1935.

The following were present :—

1. Col. A. Olyer.
2. Dr. F. J. Warth.
3. Dr. P. E. Lander.
4. Dr. K. C. Sen.
5. Rao Bahadur B. Viswanath.
6. Mr. J. R. Haddow.
7. Mr. F. Ware.
8. Mr. C. H. Parr.

Rai Bahadur Malik Charan Das, *Secretary.*

*Application from the United Provinces Government for a grant of Rs. 1,96,720 (non-recurring Rs. 19,000 and recurring Rs. 1,77,720) spread over five years for a scheme of practical research into the feeding of cattle at the departmental farms. (Subject No. 47 on the agenda of the Board).*

To deal with the scheme submitted by the Government of the United Provinces for research into the feeding of cattle at Departmental Farms it was decided that though it was necessary that work of this type should be carried out in all the Major Provinces, the scheme as put up was far too comprehensive to be dealt with by a small animal nutrition section. Much of the work proposed would be for the Central Institute to deal with and after some discussion it was agreed that work under this scheme should be confined to the following :—

(i) To study the values of three cultivated fodder crops on production rations with growing and milking cattle using two breeds, namely, Hissar cattle and Murra buffaloes.

(ii) Investigation of the comparative feeding values of food grains, oil cakes and other agricultural bye-products for production rations of these two breeds.

(iii) It was agreed that the mineral metabolism of the growing cattle of these two breeds should also be studied at the same time.

It was decided that the Deputy Director of Agriculture in charge of livestock should put up a fresh scheme on these lines for the consideration of the Committee at its next meeting.

A. OLVER.

DELHI;

The 22nd February 1935.

## APPENDIX XXXVIII.

NOTE DATED THE 28TH JANUARY 1935, BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT No. 27 :—APPLICATION FROM THE GOVERNMENT OF BOMBAY FOR A GRANT OF RS. 24,680 SPREAD OVER TWO YEARS FOR A SCHEME FOR THE DEVELOPMENT OF HEMP MANUFACTURES IN INDIA.

Attention is invited to the attached copy of a letter from the Government of Bombay No. 223/33-D., dated the 15th June, 1934, (Annexure I) forwarding a scheme by the Director of Industries, Bombay, for the development of sann hemp manufactures in India. A copy of the further correspondence with the Bombay Government, details of which are given below on the subject of this scheme is also attached (Annexure II). The Scheme involves, so far as the Council is concerned, an expenditure of Rs 24,680 spread over two years.

1. Letter to the Government of Bombay, No. D-2410/34/A., dated the 7th August, 1934.
2. Letter from the Government of Bombay, No. 223/33-D., dated the 12th December, 1934.

2. As in the case of the sann hemp schemes considered by the Advisory Board at its meeting held in September 1934, the Vice-Chairman to the Council is of the opinion that the application should first be considered by a Sub-Committee consisting of :—

1. The Vice-Chairman, Imperial Council of Agricultural Research, Chairman *ex-officio*.
  2. The Agricultural Expert, Imperial Council of Agricultural Research.
  3. The Director of Agriculture, Madras.
  4. The Director of Agriculture, Bombay.
  5. The Director of Agriculture, Bengal.
  6. The Director of Agriculture, United Provinces.
  7. The Director of Agriculture, Bihar and Orissa.
  8. The Director of Agriculture, Central Provinces.
- Secretary, Imperial Council of Agricultural Research—Secretary *ex-officio*.

The Sub-Committee will meet on some convenient afternoon between the 18th and 23rd February, 1935, and its report will be submitted to the Board in due course.

## ANNEXURE I.

COPY OF LETTER No. 223/33-D., DATED THE 15TH JUNE, 1934, FROM THE SECRETARY TO THE GOVERNMENT OF BOMBAY, GENERAL DEPARTMENT, TO THE SECRETARY IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.

SUBJECT :—*Hemp manufactures in India.*

*Scheme by Director of Industries for development of ———.*

*Grant-in-aid by Imperial Council of Agricultural Research.*

I am directed by the Government of Bombay (Transferred Departments) to refer to your letter No. 120/Agri., dated the 14th January 1933, inviting attention to the recommendation made in the report on Hemp Marketing in India by Mr. T. S. Sabnis regarding the development of the industrial utilization in India of Sann hemp by the manufacture of ropes, matting, canvas, etc., and stating that the Imperial Council of Agricultural Research would be prepared to consider applications for grants for research in this connection. In reply, I am to forward herewith copy of a scheme (with 150 spare copies) which was prepared by the Director of Industries, Bombay and to state that the scheme was placed for consideration before the Bombay Provincial Agricultural Research Committee and was approved by all the members of the Committee except one. I am also to state that the Government of

Bombay have also considered the scheme and find that it is suitable and worth a trial. They have noted that the following are briefly the main features of the scheme :—

(i) *Object of the scheme.*—It is (1) to improve the cultivation of hemp plant, (2) to introduce improved methods for extracting the fibre and (3) to put the fibre on the market both for export trade and for local use on industrial basis.

(ii) *Scope of the scheme.*—To achieve the object in view experimental work would be needed. An expenditure to the extent of Rs. 12,340 per annum for two years as detailed in paragraph 5 of the scheme would have to be incurred in the first instance. After experimental work proves successful, it will be necessary to give demonstrations to agriculturists and cultivators and conduct propaganda suggesting the adoption of the improved methods in the cultivation of their farms.

2. In these circumstances, I am to state that the Government of Bombay recommend the scheme for the approval of the Imperial Council of Agricultural Research and for grant of Rs. 12,340 per annum for two years to meet the expenditure as detailed in paragraph 5 of the scheme.

## HEMP AND ITS MANUFACTURES.

### (GENERAL.)

The Revenue Department has referred to this Department the communication received from the Imperial Council of Agricultural Research on the utilisation of Hemp fibre grown in the Bombay Presidency. This Department has been for some time considering the question of encouraging local manufactures from Hemp fibre such as ropes, cordage, cheap quality canvas bags, etc. The term Hemp fibre has unfortunately been applied to various fibres which differ greatly from the true hemp—botanical name *Cannabis Sativa*—and this has led to great confusion specially in statistical returns to which commonly no descriptive prefix is attached. The grades of the qualities of Hemp fibre which are claimed as hemp fibres are as follows :—

<i>Soft Hems</i> . . . . .	<i>Cannabis Sativa.</i>
Ambadi Hemp . . . . .	<i>Hibiscus Cannabinus.</i>
Sunn Hemp . . . . .	<i>Crotalaria Juncia.</i>
Jute . . . . .	<i>Corcharus Capsularis.</i>
Bhimliputain Jute . . . . .	<i>Corcharus Ollitorius.</i>
<i>Hard Hems</i> . . . . .	<i>Hibiscus Cannabinus.</i>
Gayapat, Gayal or Kheti . . . . .	<i>Agave American.</i>
Aloe . . . . .	<i>Agave Sisalanus.</i>

In the European countries such as Russia, France, Italy and Germany, the species of Hemp grown is *Cannabis Sativa* the true hemp and is cultivated in four varieties. There are also other kinds of fibre which are grown to a very small extent in India, such as Manilla Hemp, *Crotalaria* Hemp, Agave (indigenous), Mauritius Hemp and others. The real Indian hemp is the Sunn Hemp, vernacular Tag, designated by the botanical names of *Crotalaria Juncia* and *Cannabis Sativa*. In the Bombay Presidency the following qualities of Hemp fibres are mainly cultivated, viz :—

Ambadi . . . . .	<i>Hibiscus Cannabinus.</i>
Sunn . . . . .	<i>Crotalaria Juncia.</i>
Gayal . . . . .	<i>Agave American.</i>

### PRESENT STATE OF DEVELOPMENT.

2. In the Bombay Presidency the cultivators of hemp have been experiencing considerable vicissitudes. The acreage under cultivation has varied from 165,000 acres in 1924-25 to 95,000 acres in 1932-33 (Chart I).

Hemp is cultivated to a greater extent as a manure by the cultivators and to a lesser extent for fibre extraction. A small portion of the extracted fibre is utilized by cultivators for manufacture of cordage for agricultural and other uses. Hemp

fibre is not utilized to any appreciable extent for manufacture of cordage twines, yarn and allied manufactures, but is to a large extent an export trade chiefly in the British Empire.

The best quality of Indian Hemp is grown in the Ratnagiri District of the Bombay Presidency and is termed the "Devguddy Hemp". This class of hemp has been very favourably commented upon by different authorities.

Hemp fibre is extracted in the Bombay Presidency mainly from two species of plants, viz., *Hebiscus Cannabinus* (Ambadi) and *Crotalaria Juncia* (Sunn). The latter is by far the best quality and is so far the most important one. The acreage under cultivation during 1932-33 was as follows:—

Ambadi . . . . .	59,144 acres.
Sunn . . . . .	35,618 acres.

If all the Hemp plants under cultivation were to be utilized for extraction of fibre the annual production of fibre would be as follows:—

Ambadi . . . . .	16,400 tons based on 1,000 lbs. fibre per acre.
Sunn . . . . .	8,000 tons based on 500 lbs. fibre per acre.

In Statement No. 1 acres of Hemp cultivation are given for the different districts in the Bombay Presidency during 1932-33.

#### POSSIBILITIES OF COMMERCIAL EXPLOITATION.

3. (a) *Export*.—In the pre-war periods India had a good share of the European market, which increased rapidly during the war period. But during the post-war period Indian Hemp exports have steadily declined. There are several factors which have brought this about, such as irregularities in the cleaned fibre, a large amount of dust to make up for the weight and the unreliable grading of fibres in a bale. English fibre experts (Empire Marketing Board report) have commented very favourably on the quality and strength of the Indian hemp fibre and have stated that if the above irregularities would be eliminated the Indian Hemp will have its legitimate share in European markets together with a better price realized per ton of fibre.

(b) *Manufactures*.—Along the coast line of Bombay Presidency and Sind there are 3,462 sea-going fishing boats which use hemp fishing twine for making fishing nets, as this quality of fibre wears well in sea water. The average life of a deep sea fishing net is about two years. The average cost of a fishing net is Rs. 500. It will, therefore, be realized that there is a large consumption of Hemp twine which is now chiefly imported from Italy. Besides this considerable import trade is being done in cheap canvas binder twine, cheap cordage, saddlers' and shoe-makers' twines, seaming twines coarse twines and shop twines, etc., which can all be made locally from the local Hemp fibre.

#### LINES ON WHICH ACTION MIGHT BE TAKEN TO DEVELOP THE HEMP FIBRE TRADE AND ENCOURAGE MANUFACTURES FROM IT LOCALLY.

4. In the report on Hemp Marketing in India by Mr. Sabnis considerable amount of information about the occurrence of hemp plant in the Bombay Presidency is given. The Department of Industries has also during the last several months conducted enquiries from the Revenue officials and officers of the Department of Agriculture about the occurrence of hemp plant and its extent in the Presidency.

There is no doubt that large quantities of hemp plant are available and fibre is extracted to an appreciable extent. The fibre is extracted, however, by crude methods and as pointed out in a previous paragraph, the condition in which it is made available for the market is such that the fibre does not fetch a high price.

What should be done, therefore, is that (a) experiments should be conducted to make available improved types of simple appliances or equipment which could be used by agriculturists to extract fibre in a more satisfactory manner than is the case at the present time and (b) experiments will also be necessary to use the fibre so extracted for the manufacture of several articles, such as fishing twine, binder twine, cordage, etc.

For all this, a considerable amount of experimental work by a specialist will be necessary. It is, therefore, suggested that a Fibre Expert with special knowledge



of machinery used both in the extraction of the fibre from the plant and its utilisation for the manufacture of the several articles mentioned above, should be engaged for two years in the first instance. A certain amount of money will also be necessary for the purchase of fibre and experimental appliances. It will also be desirable to arrange for the fibre to be tested in one or two European countries by manufacturers of machinery required for the above purpose.

5. A rough estimate for the total expenditure involved is given below :—

<i>Estimated Expenditure per year.</i>	Rs.
(a) Fibre Expert for one year on a salary of Rs. 500 per month	6,000
(b) One clerk at the rate of Rs. 50 per month	600
(c) One peon at Rs. 20 per month	240
(d) Travelling allowance	1,000
(e) Experimental grant—which will cover the cost of the appliances, wages of the necessary one or two men to operate these appliances, raw material, etc. It will also include cost of fibre which may have to be sent abroad for testing and manufacture of hemp yarn	4,000
(f) Contingencies	500
	12,340
	per year.

The total expenditure per year will be Rs. 12,340. For the period of two years for which the scheme is recommended the cost will be Rs. 24,680.

After the Fibre Expert has carried out the necessary experimental work and assuming that he has made available any appliances whether of his own design or purchased from manufacturers abroad which could suitably be demonstrated in the villages, it will be necessary to engage one or two demonstrators to demonstrate the appliances practically to the agriculturists in the various centres. Proposals for this work can only be put up after the results of the work of the Fibre Expert recommended above are available.

P. B. ADVANI.

3rd February 1934.

STATEMENT No. 1.

*Acreege under Hemp cultivation in Bombay Presidency.*

Year.	Bombay.	Outturn in tons.
1909-10	155,599	34,231·78
1910-11	143,895	21,656·90
1911-12	Not available.	
1912-13	114,728	25,240·16
1913-14	134,234	29,531·48
1914-15	155,163	34,135·86
1915-16	144,482	31,786·04
1916-17	Not available.	
1917-18	117,958	25,950·76
1918-19	81,664	17,966·08
1919-20	111,357	24,498·54
1920-21	81,329	17,892·38
1921-22	104,016	22,883·52
1922-23	107,446	23,638·12
1923-24	120,365	26,480·30
1924-25	162,445	35,737·90
1925-26	105,252	23,155·44
1926-27	99,798	21,955·56
1927-28	109,795	24,154·90
1928-29	102,629	22,578·38
1929-30	92,910	20,440·20
1930-31	Not available.	
1931-32	Do.	
1932-33	94,762	24,400

## STATEMENT No. 2

## Exports of Hemp.

Year.	Quantity.		Value.	
	Bombay and Karachi (Sind).	India.	Bombay and Sind.	India.
	Tons.	Tons.	Rs.	Rs.
1909-10	11,453	24,034·75	29,95,485	59,56,920
1910-11	10,442·6	25,009·35	26,83,740	61,47,285
1911-12	9,638·55 05	26,547·45	27,95,085 150	71,58,240
1912-13	12,744·6	31,163·45	43,31,235	96,35,595
1913-14	11,239·5	35,577·40	36,50,940	1,02,34,785
1914-15	13,508·6 33·75	33,511·35	45,41,490 9,180	99,43,335
1915-16	11,679·25 3	30,413·35	41,87,880 300	1,02,53,745
1916-17	17,247·80	36,610·65	81,87,540	1,61,11,860
1917-18	7,589·85 2·25	15,335·80	48,10,455 1,230	79,44,030
1918-19	8,740·60	24,471·00	79,53,420	1,46,79,630
1919-20	10,806·70	37,105·45	75,97,090	1,89,40,970
1920-21	4,806·15 1·0	20,397·55	28,18,160 1,040	86,15,490
1921-22	2,491·25	12,810·15	10,51,488	39,35,760
1922-23	5,679·9	20,622·15	19,35,014	60,84,724
1923-24	5,104·25	22,942·35	18,92,151	76,42,682
1924-25	9,221·3	33,437·00	54,93,018	1,72,87,124
1925-26	9,000·5	31,197·45	48,16,465	1,59,17,310
1926-27	4,819·2	21,991·60	18,58,056	82,76,495
1927-28	5,615·7	24,207·3	22,00,600	80,83,113
1928-29	4,386·3	28,054·85	16,38,341	87,51,879
1929-30	5,178·6	21,747·95	18,58,387	68,33,083
1930-31	3,127·2	14,657·55	9,55,697	89,30,344
1931-32	3,124·75	11,199·7	7,34,082	26,89,572

## STATEMENT No. 3.

*Average price of Hemp fibre f. o. b. Bombay Harbour.*

Year.	Price per ton in Rupees.
1909-10	261.55
1910-11	257.00
1911-12	289.99
1912-13	339.84
1913-14	324.83
1914-15	336.19
1915-16	358.57
1916-17	474.70
1917-18	633.80
1918-19	909.95
1919-20	703.00
1920-21	586.36
1921-22	422.07
1922-23	340.68
1923-24	370.61
1924-25	595.69
1925-26	535.13
1926-27	385.55
1927-28	391.86
1928-29	373.51
1929-30	358.86
1930-31	305.60
1931-32	234.92
1932-33	240.27

## ANNEXURE II.

COPY OF LETTER No. D-2410/34/A., DATED THE 7TH AUGUST, 1934, FROM THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, TO THE SECRETARY TO THE GOVERNMENT OF BOMBAY, GENERAL DEPARTMENT.

*Scheme by the Director of Industries for development of hemp manufactures in India.*

I am directed to refer to your letter No. 223/33-D. dated the 15th June 1934, forwarding the scheme mentioned above and to request that additional information on certain points may kindly be furnished to this Department as early as possible.

2. In your letter under reply two of the objects of the scheme have been stated to be "to improve the cultivation of the hemp plant" and "to put the fibre on the market both for export and for local use on an industrial basis". As the scheme forwarded deals only with (i) improved appliances for extracting the fibre; and (ii) experiments in the manufacture of twine and other articles, I am to enquire what steps it is proposed to take to improve the cultivation of the hemp plant and the marketing of the fibre.

3. Information is also desired as to where the proposed fibre Expert will work, what laboratory and workshop accommodation will be provided for him, what his qualifications will be and how it is proposed that he should be recruited. It may be observed that machinery is nowhere used for the extraction of sann hemp (which is essentially an Indian fibre) and that the other hems are both botanically and structurally different from sunn hemp; hence there may be considerable difficulty in obtaining a Fibre Expert with the qualifications specified and it seems rather much to expect that the same Expert will be qualified to carry out experiments in the manufacture of twine.

4. Detailed estimates showing how it is proposed to use the experimental grant of Rs. 4,000 per annum may also kindly be furnished.

5. I am to add that the scheme will be placed before the Advisory Board at its next meeting in September if the information referred to above is received in time.

COPY OF LETTER No. 223/33-D., DATED THE 12TH DECEMBER, 1934, FROM THE SECRETARY TO THE GOVERNMENT OF BOMBAY, GENERAL DEPARTMENT, TO THE SECRETARY TO THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.

SUBJECT :—*Scheme by the Director of Industries for development of Hemp Manufactures in India.*

I am directed by the Government of Bombay (Transferred Departments) to refer to your letter No. D.2410/34/A., dated 7th August 1934 and to reply as under.

2. The following are briefly the main features of the scheme :—

1. To improve the cultivation of the Hemp Plant.
2. To introduce improved methods in extracting, cleaning and grading the hemp fibre.
3. To put the fibre on the market both for export trade and local consumption.

To achieve the objects in view experimental work would be needed. An expenditure of Rs. 12,340 per annum for two years would have to be incurred in the first instance. If the experimental work proves successful, there will be demonstrations and propaganda for the adoption of improved appliances for extraction of fibre, and methods of cultivation.

3. The Imperial Council of Agricultural Research in the letter above have asked for additional information on the following points :—

1. What steps it is proposed to take to improve the cultivation of the Hemp Plant and the marketing of the Hemp fibre.

2. (a) Where the fibre expert would work and what laboratory and workshop facilities will be provided for him.

(b) What should be his qualifications and how it is proposed to recruit him.

(c) Whether the fibre expert could carry out experiments in the manufacture of twine.

3. Detailed estimates showing how it is proposed to use the experimental grant of Rs. 4,000 per annum, included in the total annual grant of Rs. 12,340 mentioned in paragraph 2 above.

4. *Steps for improving cultivation of Hemp and marketing—*

(a) *Cultivation.*—Experiments for the improvement of the cultivation of hemp would be carried out by the Agricultural Department in co-operation with the Department of Industries. The Agricultural Department have already submitted, separately, to the Imperial Council of Agricultural Research a scheme for a three years study of certain problems of hemp cultivation and experiments for improving the quality of the fibre. The sum of Rs. 200 included under the Experimental Grant of Rs. 4,000, will be for further special cultivation method that the fibre expert may desire to be tried.

These experiments will also be run by the Agricultural Department. There will thus be no overlap between the work of the Industries and Agricultural Departments. The Agricultural Department will devote itself mainly to questions of cultivation, such as increase of yield, improvements of quality of cultivation method e.g., manuring, alteration of sowing dates, etc., and changes in retting.

(b) *Marketing.*—It is important to note that the scheme is intended chiefly to improve the present methods of extracting, cleaning and grading of the fibre. So that when the fibre is put on the market, both for export trade and local use, it would obtain a better price, with an improved demand.

Under the supervision of the fibre expert, it is expected there would be a general and definite improvement in the extraction, cleaning and grading of Hemp fibre. This would result in better prices and a larger demand from European importers, as irregularities in cleaning fibre and unreliable grading, according to the Empire Marketing Board, are the chief drawbacks to the use of Indian Hemp.

A market for export of Hemp fibre and for manufactured products from Hemp fibre already exists [Paragraph 3(b) page 2 of the Scheme]. It is intended to obtain the advice of the Marketing Officer appointed by the Government of India for further improvements for marketing the Hemp Fibre.

5. (a) *Where the Fibre Expert would work and what Laboratory and Workshop facilities will be provided for him.*

The fibre expert will be generally employed in the Hemp Districts studying the methods and appliances at present used, for the extraction, cleaning, and grading of the fibre, with a view to find out, how best these could be improved.

Laboratory and workshop facilities for the fibre expert could be provided at the Victoria Jubilee Technical Institute, Bombay, at Poona, or at a selected centre in the Hemp District. The selection of the centre for the Laboratory and workshop will be made by the fibre expert. Laboratory and workshop equipments are detailed in paragraphs 6 and 7 below.

(b) *What should be the qualifications of the fibre expert and how it is proposed to recruit him.*

It is proposed to engage a Fibre Expert with sound practical knowledge of fibre-extracting machinery both hard and soft fibres, one who has been in charge of power-driven factories for extracting hard and soft fibres. His knowledge of machinery would be useful in devising hand appliances for extracting the local Sann Hemp fibre and his practical experience would be of benefit in instructing local workers in cleaning and grading fibre. It is proposed to recruit a fibre expert by advertisement in India and Kenya Colony in East Africa where Hemp fibre is an important industry.

It is not intended to use power machinery for extracting and cleaning Hemp fibre. The scheme is for devising only hand appliances. There should therefore be not much difficulty in obtaining a suitable fibre expert.

(c) *Whether the fibre expert could carry out experiments in the manufacture of twine.*

With regard to the experiments in the manufacture of twine, it should be noted that the work is very simple and can be carried out by anyone with ordinary experience of machinery. Not much difficulty is anticipated in this connection as the work of the fibre expert in this connection would be minimised. It is proposed to send 3 tons of Sunn Hemp fibre to Europe and England to test out the spinning qualities of the Sunn Hemp Fibre. The machinery factories would be able to report on the spinning qualities of the fibre and the fineness of yarn which could be spun from it. The yarn would then be utilised for making fine cordage or twine. This can be carried out locally and quite easily by the fibre expert. Moreover it should be noted that the fibre expert will work under the supervision of the Industrial Engineer of the Department of Industries, who has considerable experience of the Engineering side of the manufacture of textile fibres, and would be able to further guide if necessary the fibre expert in carrying out such experiments.

6. *Detailed estimate regarding experimental grant of Rs. 4,000.*

First Year.

	Rs.
(1) Expenditure for equipping, office, and a Laboratory with simple laboratory types of fibre testing machine, fibre reeling and winding machine, fibre examining machine fitted with microscope, and, a small workshop with hand worked engineering and other tools necessary for his experiments	1,200
(2) Expenditure for sending 3 tons of Hemp fibres to different European and English machinery manufacturers for testing out the spinning qualities of hand-extracted hemp fibre, and, report on the possibilities of the use of the yarn for the manufacture of cordage, fine twine, cheap canvas, etc. The expenditure includes cost of fibre, freight, insurance, packing, duty and charges for carrying out the tests on the spinning qualities of the Hemp fibre	1,200
(3) Wages of labour (daily during the year for assisting in the work at the Laboratory and workshop and testing experimental hand fibre extracting and cleaning appliances	480
(4) Expenditure which would be incurred for manufacturing of Experimental fibre extracting and cleaning appliances	300
(5) Expenditure for purchase of hemp fibre for experimenting on the hand appliances under (4) above	200
(6) Rent for suitable premises which would be an office, laboratory and workshop (if no Government Building is available)	420
(7) Expenditure on experimental cultivation of hemp for one year	200
	4,000

7. Detailed estimate regarding experimental grant of Rs. 4,000—Second Year.

It is proposed in the second year to carry out practical tests and demonstrations of the use of improved appliances and methods of extracting, cleaning and grading of hemp fibre. This work is considered as an essential part of the scheme, for unless it is ascertained by practical demonstrations as to whether or not agriculturists and others can and will profitably adopt the improved appliances final conclusions on the advantages or otherwise of the scheme cannot be drawn. If as a result of practical tests and demonstrations it is found that the people concerned can profitably use the appliances in question and will actually do so, Provincial Government will consider the question of providing in future years for demonstration parties with a view to further popularising the improved appliances in suitable areas.

	Rs.
(1) Two Peripatetic Demonstration Parties at Rs. 1,250 per party per annum (Rs. 200 non-recurring and Rs. 1,050 recurring per annum, this is based on the average cost of one Weaving Demonstration per annum) . . . . .	2,500
(2) Wages of labour (daily) during the year for assisting in the work at the Laboratory and workshop and testing hand fibre extracting and cleaning appliances . . . . .	480
(3) Expenditure which would be incurred on the manufacture or purchase of Experimental fibre extracting and cleaning appliances . . . . .	100
(4) Expenditure for purchase of hemp fibre for experimental on hand appliances under (3) above . . . . .	200
(5) Rent for suitable premises which would be an office, laboratory and workshop (if no Government Building is available) . . . . .	420
(6) Further expenditure on Experimental Cultivation of Hemp for one year . . . . .	300
	4,000

8. During the course of the experiments it may be necessary to amend or modify some of the activities and items of expenditure, to which, the Imperial Council of Agricultural Research may please accord their approval.

It is requested that the detailed estimates under paragraphs 6 and 7 above for the 1st and 2nd year be considered as Enclosures 1 and 2 of the original scheme forwarded under cover of this office letter No. 223/33/D., dated 15th June 1934.

## APPENDIX XXXVIII-A.

REPORT OF THE SUNN HEMP SUB-COMMITTEE (18TH FEBRUARY 1935).

*Present :*

Mr. B. C. Burt, *Chairman*.  
 Mr. R. G. Allan.  
 Mr. K. McLean.  
 Dr. B. Narasimha Iyengar.  
 Mr. B. S. Patel.  
 Mr. J. H. Ritchie.  
 Mr. D. R. Sethi.  
 Mr. H. R. Stewart.

*Subject 27.—Application from the Government of Bombay for a grant of Rs. 24,630 for the development of hemp manufactures in India. (Appendix XXXVIII).*

The main features of the scheme as put forward by the Government of Bombay are :—

- (1) To improve the cultivation of the hemp plant,
- (2) To introduce improved methods in extracting, cleaning and grading the hemp fibre, and
- (3) To put the fibre on the market both for export trade and local consumption.

The first item is already partly covered by the scheme which was sanctioned, and the grant made, to the Bombay Agricultural Department. A supplementary proposal under subject 26 has been deferred until the next meeting of the Advisory Board.

Improved methods of extracting and cleaning hemp fibre are covered by the grant sanctioned on the recommendation of the Advisory Board, made in August 1933, for a three-year scheme in the United Provinces. For this reason the Advisory Board in August 1934 did not recommend a grant to the Central Provinces for the same purpose. Moreover, experiments are already in progress under the Fibre Expert, Bengal, on the extraction of sunn hemp by methods similar to those in vogue for flax. We do not consider it necessary to make a further grant for this portion of the scheme.

The better grading and marketing of hemp fibre will be dealt with in the marketing surveys and the Committee recommends that no further action be taken in that direction until the results of the survey are available. Experiments are also proposed in the manufacture of rope and twine. The Sub-Committee do not consider that experimental work on this subject is necessary as the use of Indian sann hemp in rope and twine manufacture is already well established and there are successful commercial rope works in India.

With reference to paragraph 5 of the Bombay Government's letter of 12th December 1934, the Sub-Committee do not consider that experience of the extraction of sisal fibre in East Africa would be of any particular advantage in connection with experimental work on Indian sunn hemp.

The Sub-Committee recommend that the scheme be rejected.

B. C. BURT.

DELHI,

*The 18th February 1935.*

## APPENDIX XXXIX.

NOTE DATED THE 11TH FEBRUARY 1935 BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT NO. 32.—APPLICATION FROM THE DIRECTOR GENERAL OF OBSERVATORIES, POONA, FOR A GRANT OF RS. 1,39,000 SPREAD OVER FIVE YEARS FOR A REVISION AND EXTENSION OF THE PRESENT SCHEME OF AGRICULTURAL METEOROLOGY ALREADY SANCTIONED BY THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.

A research scheme on Agricultural Meteorology involving a grant of Rs. 2,05,000 spread over five years was sanctioned by the Governing Body in August 1930. Before the scheme was started the Council's Annual research grant was suspended and a review of the position of the various research grants became necessary. In consultation with the Director General of Observatories it was decided that, rather than postpone the Agricultural Meteorology Scheme, it should be sanctioned for three years in the first instance and on a reduced scale of expenditure. The Revised Sanction was conveyed to the Scheme on the scale mentioned in para. 3 of the attached copy of Director General of Observatories letter dated the 15th January 1935 (Annexure). The work started from the 21st August 1932 and the present financial sanction will therefore expire on the 21st August 1935 unless extended by the Vice-Chairman for the full period of five years originally sanctioned by the Governing Body. Two progress reports on its working, for the years ended 21st August 1933 and 1934, respectively, have been received. The first of these was considered by the Advisory Board at its meeting held in February 1934. (*Vide* pages 41 and 451-462 of the printed progress of the Board) and the second one is being submitted to the Board at the present meeting (*vide* item No. 9 of the agenda).

2. Attention is now invited to the attached copy of a letter from the Director General, Observatories, No. 1372/E-4, dated the 15th January 1935 (Annexure) containing a proposal for the revision and continuance of the scheme for a period of five years from the 21st August 1935, the date on which the present period of its sanction on a reduced scale expires. This proposal involves, so far as the Council is concerned, expenditure of Rs. 1,39,000 during the next five years but it does not involve any grant beyond the balance of the total grant (Rs. 2,05,000) already sanctioned by the Governing Body. If the present proposals are accepted the total expenditure in 8 years will be slightly less than the amount originally sanctioned for five years.

3. The views of the Board on the Director General of Observatories' suggestions for the ultimate establishment of a permanent branch for Agricultural Meteorology are also invited.

4. The Vice-Chairman to the Council considers that it would be of advantage to have the proposal examined first by a Sub-Committee of the Board consisting of:—

The Vice-Chairman, Imperial Council of Agricultural Research, Chairman *ex-officio*.

The Agricultural Expert, Imperial Council of Agricultural Research.

The Director, Imperial Institute of Agricultural Research, Pusa.

All the Directors of Agriculture present at the Board.

The Chief Agricultural Officer, Sind.

The Imperial Agricultural Chemist (if in Delhi).

The Director, Indian Institute of Science, Bangalore.

Professor T. Ekambaram.

Dr. Ram Das, Agricultural Meteorologist.

The Secretary, Imperial Council of Agricultural Research, Secretary *ex-officio*.

This Sub-Committee will meet on an afternoon between the 18th and 23rd February 1935, and its report will be submitted to the Board in due course.

## ANNEXURE.

LETTER NO. AGRI. MET.-1372/E.-4, DATED THE 16TH JANUARY 1935, FROM THE DIRECTOR GENERAL OF OBSERVATORIES, POONA, TO THE VICE-CHAIRMAN, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.

I have the honour to submit proposals for the revision of the Scheme on Agricultural Meteorology and its extension for a period of five years with effect from 22nd August 1935.



It may be recalled that in letter No. 222-Agri., dated the 7th February 1931, the Department of Education, Health and Lands, conveyed the sanction of the Imperial Council of Agricultural Research for the establishment of a new Branch on Agricultural Meteorology under the India Meteorological Department with a recurring grant of Rs. 38,000 per annum for five years, and a non-recurring grant of Rs. 10,000 for instruments and Rs. 5,000 for the deputation of one or both the officers to be appointed to Europe. The total expenditure sanctioned for the above Scheme by the Imperial Council of Agricultural Research was Rs. 2,05,000.

With the advent of the retrenchment campaign towards the end of 1931, the Scheme was delayed and it was agreed later, when the position became clearer, to make a beginning with reduced staff and funds during the first three years and review the position during the third year (*vide* letter No. F-49-A./32, dated the 22nd July 1932, from the E., H. and L. Department). Accordingly the new Branch began functioning on the 22nd August, with a Junior Agricultural Meteorologist in charge of a staff of one Professional Assistant and two senior and three junior observers. For ready reference a statement showing the items originally sanctioned and then actually provided for during the first three years is given below:—

Items,	As sanctioned in the full Scheme.	As accepted during the first 3 years.
	Rs.	Rs.
<i>Average cost per annum.</i>		
1. Senior Agricultural Meteorologist on Rs. 600—50—800.	8,400	
2. Junior Agricultural Meteorologist on Rs. 400—50—600.	6,000	6,000
3. Professional Assistant Rs. 250—20—330 .	3,480	3,480
4. One Assistant on Rs. 160—10—200 .	2,160	..
5. Senior Computers and Observers on Rs. 100—5—120.	3,960 (three).	2,640 (two).
6. Computers, Clerks etc. on Rs. 50—5—70 .	3,600 (five).	2,160 (three).
Total Staff .	27,600	14,280
7. Provident Fund at 6½ per cent. . . . .	1,725	893
8. Travelling allowances and office expenses . . . . .	3,500	1,500
9. Experimental work . . . . .	5,000	2,000
Total .	37,825	18,673
or	38,000	
10. Instruments for nine stations (non-recurring)	10,000	..
11. Deputation of officers to England (non-recurring).	5,000	..

In my letter G. S. No. 2283/E-21/A., dated the 26th January 1932, I had indicated that the reduced Scheme in order to function successfully during the first three years would require a Meteorologist and a Professional Assistant with real drive and that the Meteorologist should be capable of drawing up and prosecuting a research programme on his own. I am glad to state that owing to the happy choice of personnel the Agricultural Meteorology Branch has done excellent pioneer work in this new Science. The work done during the first two years of its existence will be seen from the two Annual Reports which have been submitted to the Imperial Council of Agricultural Research under cover of this office letters Agri. Met. No. 448/R.-3, dated the 18th September 1933 and No. 1242/R.-3, dated the 6th October 1934, respectively, and from the enclosed report on the progress of Agricultural Meteorology in India during the last 3 years, which is being sent to the International Commission on Agricultural Meteorology which meets in September 1935 at Warsaw. We are in a position now to lay plans for the future with more practical knowledge and experience than we had three years ago.

I would like to state my present conviction that in the new subject of "Agricultural Meteorology" which is in its infancy in all countries, the present 'investigational' or 'fact-finding' outlook should continue uninterrupted for some years to come. What is required at present is a small but efficient organisation assisted by a few enthusiastic investigators working for a long time rather than a large staff with only a short period in which to hurry their endeavours. It may be expected also that the Agricultural Meteorology Branch will continue to attract honorary post-graduate research students from different universities as during the past three years. At present six such honorary workers are carrying on research work on different problems of fundamental interest under the guidance of the Agricultural Meteorologist. Their co-operation has been valuable for making progress on items on which work could not have been undertaken otherwise.

Before taking up the detailed proposals the future outlook of the Agricultural Meteorology Branch may briefly be indicated.

#### *A. Experimental or Biological.*

The present investigational work of a fundamental nature on micro-climatology, soil meteorology, etc., should continue at Poona. This should be slowly extended to other centres in India so as to complete the survey. The above work should be supplemented by a Scheme of "Precision observations of weather and crop" on the lines of work initiated at Poona. The aim will be to evolve a system of collecting relevant crop and weather data side by side which will provide complete information for a few crops at selected centres. The devising of new instruments which will help in Agricultural meteorological work should continue uninterrupted. The aim will be to make available to agricultural workers a number of simple, inexpensive and efficient instruments. The instances of thermo-couple sets for measurement of plant temperatures, evaporimeters and percolation gauges which have been completed already may be referred to. Another instrument which promises to be of great use to agricultural workers is a porous candle manometer which it is hoped, will enable one to read off the moisture content of the soil "in situ". Other similar instruments of a useful character may be looked forward to.

#### *B. Statistical.*

The main item of work under this head will be :-

- (1) The analysis of the local experimental data and of the "Precision" observations so that these may be studied as fast as they accumulate and the results made available to the Agricultural Public.
- (2) The analysis of past statistics of weather in different areas with the special object of investigating possibilities of forecasting types of weather which are of agricultural importance in different areas.
- (3) The analysis of "Season and Crops" and Experimental Farm data as well as of the meteorological factors over corresponding areas. In the case of the former the division of the country into small areas with more or less uniform distribution of weather factors as well as of the crops under investigation is a very important preliminary to any reliable correlation studies.

#### *C. General.*

1. The present contact with agricultural workers with a view to create interest in Agricultural Meteorology standardise Agricultural Meteorological Observatories, render advice, give training, etc., will continue.
2. Collection of information regarding the weather requirements of crops, critical periods, etc., will be done systematically for different parts of India. Also the Section will endeavour to explore possibilities of short-period forecasts by "statistical" methods, and from the "daily weather chart". With increasing interest in rural welfare the installation of "rural broadcasting centres" may be expected to engage the attention of Government in the near future. That would provide opportunities for the Agricultural Meteorology Branch, if it becomes permanent at the end of its "temporary" career, to collaborate with the forecasting sections of the different Meteorological centres in India, in the issue of forecasts and warnings for helping the farmer.

#### *Proposals.*

It is proposed to continue the Scheme for five more years (after the expiry of the third year on 21st August 1935) with a few essential minor additions to the existing

staff and funds. The position may be reviewed again at the end of that period i.e., in 1939 and Government may then perhaps be approached on the subject of continuing the Section on a permanent basis.

In submitting the present proposals I have especially kept in view the fact that the Imperial Council of Agricultural Research should not be committed to a total expenditure exceeding the sum of Rs. 2,05,000 which the Governing Body sanctioned about three years ago.

The minor additional facilities required during the five years of extension are as follows :—

1. *Funds for Experimental Work.*—The main items under this head are :—

- (a) the maintenance of the Central Agricultural Meteorological Observatory,
- (b) the contingent expenditure in connection with the research work carried on in the "laboratory" as well as in the "open" by the Experimental Section of the Branch,
- (c) expenditure on models of new instruments, and
- (d) replacement or renewal of parts of routine instruments, charts of self-recording instruments, purchase of new instruments, etc.

Considerable difficulty is being experienced in keeping up the activities of this Section within the present allotment of Rs. 2,000. The allotment may be increased to Rs. 4,000 per year.

2. *T. A. and Office Expenses.*—The present grant for Travelling Allowance and office expenses is Rs. 1,500 per year. It is necessary to provide increased facilities for the officers and occasionally a senior member of the staff of the Branch to visit important agricultural centres in India, to come in contact with workers and their special problems, and to extend work on agricultural meteorology on uniform lines. The allotment under this sub-head may be increased from Rs. 1,500 to Rs. 2,000 per year.

3. *Provision for the post of a Meteorological Assistant.*—Most of the experimental work now in progress has to be supervised in all its details by the Agricultural Meteorologist. This has involved a considerable strain on the officer-in-charge. In order that he may get some skilled assistance in the design and trial of new instruments as well as in the gradually increasing work in connection with the adjustment and standardisation of instruments received from agricultural workers, I propose that the post of an Assistant in the scale of Rs. 130—8—162 may be sanctioned, the above scale corresponds to the revised scale of pay for Meteorological Assistant in the permanent service of this department. The proposed scale of pay may be expected to attract candidates who have secured the M. Sc. degree in Physics by research and who have sufficient general training in work-shop practice.

4. *Post of a Typist.*—One of the three Junior Clerks or Observers sanctioned has been fully engaged in typing and correspondence. The correspondence is largely due to enquiries from agricultural workers as well as to the numerous circulars and questionnaires which the Branch issues. Besides this, there is a considerable amount of typing in connection with the publications of the Branch. It is therefore proposed that provision be made for the post of a typist on the scale of pay of a Junior observer or clerk, viz., Rs. 50—5—70.

5. *Agricultural Meteorologist.*—Of the two posts of Meteorologists originally sanctioned only the Junior Agricultural Meteorologist's post was filled up when the Agricultural Meteorology Branch started two and a half-years ago. The question of two Meteorologists may be dropped for the present. I propose that one Meteorologist should continue to hold charge of the Branch and that the prefix "Junior" be omitted from the designation. Dr. L. A. Ramdas, the Agricultural Meteorologist will be due to receive a salary of Rs. 600, on the 22nd August 1933, and his scale of pay as Meteorologist will be Rs. 600—50—800 during the next five years.

6. *Professional Assistant.*—The scale of pay of the professional Assistant as originally sanctioned for five years was Rs. 250—20—330 the present incumbent will be due to receive a salary of Rs. 310 at the end of the first 3 years. The scale of pay will be Rs. 250—20—390 when provision is made for a further period of five years.

7. *Senior Observers or Computers and Junior Observers or Computers.*—The existing staff of two senior and three junior observers or computers are on the scale of pay of Rs. 100—5—120 and Rs. 50—5—70 respectively. These scales of pay may be extended so as to provide for five more years. The extended scales of pay will be Rs. 100—5—135 and Rs. 50—5—85 respectively.

The financial aspect of the above proposals is summarised in the statement enclosed.

**FRESH PROPOSALS.**

Item.	Scale of pay originally sanctioned.	Actual scale of pay during first three years (August 1932 to August 1935).	Scale of pay providing also for further period of five years (August 1935 to August 1940).	Recurring average annual cost for next five years (August 1935 to August 1940) provided present incumbents continue.			
	Rs.	Rs.	Rs.	Rs.	A.	P.	
1. Senior Agricultural Meteorologist . . . . .	600—50—800	<i>Nil</i>	} One Agricultural Meteorologist 450—50—800 250—20—390 130—8—162 (revised scale)	8,400	0	0	
2. Junior Agricultural Meteorologist . . . . .	400—50—600	450—50—550		450—50—800			
3. Professional Assistant . . . . .	250—20—330	250—20—290		250—20—390	4,200	0	0
4. One Assistant . . . . .	160—10—200	<i>Nil</i>		130—8—162 (revised scale)	1,800	0	0
5. Senior Computers and Observers . . . . .	100—5—120 (three posts)	100—5—110 (two posts only)	100—5—135 (two only)	3,000	0	0 (two)	
6. Computers or clerks . . . . .	50—5—70 (five posts)	50—5—60 (three posts only).	50—5—85 (three only)	2,700	0	0 (three)	
7. Typist . . . . .	<i>Nil</i>	<i>Nil</i>	50—5—70 (new post).	720	0	0 (one).	
8. One peon at Rs. 18 per month . . . . .				Rs.	A.	P.	
Total staff . . . . .				216	0	0	
Provident fund at 6½ per cent (for all except item 1 of which present incumbent is pensionable) . . . . .				21,036	0	0	
Travelling Allowance and Office expenses . . . . .				790	0	0	
Experimental work . . . . .				2,000	0	0	
Total annual expenditure . . . . .				4,000	0	0	
				27,826	0	0	
			or	27,800	0	0	
Total provision for next five years (August 1935—August 1940) . . . . .				1,39,000	0	0	
Budget grant for next financial year up to 21st August 1935 . . . . .				9,250	0	0	
Budget grant for current financial year (1934-35) . . . . .				18,819	0	0	
Budget grant for previous two years August 1932 to March 1934 . . . . .				22,254	0	0	
				1,771	0	0	
Total expenditure during the period of 8 years (1932-1940) . . . . .				1,98,094	0	0	
Total grant originally sanctioned by the Imperial Council of Agricultural Research for the Agricultural Meteorology Scheme . . . . .				2,05,000	0	0	

**REPORT ON THE PROGRESS OF AGRICULTURAL METEOROLOGY IN INDIA.  
DURING THE PERIOD 1932-1934.**

Work on Agricultural Meteorology began in India with the formation of an Agricultural Meteorology Branch at the Meteorological Office at Poona in August 1932. This new addition to the activities of the India Meteorological Department is financed by the Imperial Council of Agricultural Research, India, Dr. L. A. Ramdas, Agricultural Meteorologist has been in charge of the new Branch since its foundation.

The activities of the Agricultural Meteorological organisation come under the following heads :—

I—Experimental or Biological.

II—Statistical.

III—General.

(a) Extension of co-operation and rendering of advice on meteorological matters to agricultural workers or institutions and

(b) collection of detailed information regarding the weather requirements of crops and investigation into the possibilities of forecasting them; in general to prepare the ground for a future regular forecasting service for the benefit of the agriculturist.

A report on the progress made under different sections is given below :—

**I—EXPERIMENTAL SECTION.**

**(1) *The Central Agricultural Meteorological Observatory.***

Most of the instruments were standardised and installed by December 1933. A hut intended to serve as the nucleus of a small field laboratory was also erected at one corner and equipped with such essentials as could be purchased from the funds available. The observatory which is situated in the farm of the local agricultural College has the status of a first class observatory with gradually improving facilities for the study of (1) local climatology, (2) micro-climatology, (3) soil meteorology. (4) effective rainfall, (5) evaporation from water surfaces and from the soil, (6) solar, terrestrial and sky radiation etc. The situation and exposure of the observatory are more or less ideal and especially favourable for the study of the micro-climates of the different crops growing in the farm and for comparing these with the climate of neighbouring open spaces. Systematic records of the numerous meteorological and crop measurements are being maintained. Instruments designed locally for special purposes are also tried out in the observatory. The observatory is not only serving as a place for carrying on investigational work but also as a training ground for numerous agricultural workers interested in agricultural meteorology.

A recent photograph of the observatory is enclosed.

**(2) *Design and trial of new instruments for Agricultural Meteorological work.***—

Progress was made in the design of a few instruments with the co-operation of the Junior Work-shop Company, Hengne, Poona. The following instruments were completed.

(a) *A portable standard Thermo-couple set for the measurement of plant temperatures.*—The instrument provides a dozen thermal junctions and used in conjunction with a portable sensitive galvanometer or with a suspension coil galvanometer of local make installed in the field laboratory. The sensitive points are designed for use with the sugar-cane crop and may be easily altered to suit any other crop. Sugar-cane Specialists in India who are using this installation find it useful.

(b) *A portable percolation gauge for use in the study of percolation and effective rainfall.*—A portable percolation gauge having the same diameter as the standard Symons rain-gauge has been designed. The instrument is provided with a suitable receiver and a protecting collar outside to prevent external spray from getting into the receiver during rain. A series of these gauges containing soil 6", 1 ft., 1½ ft., 2 ft., etc. deep has been exposed in the Observatory.

(c) *Evaporimeters.*—Three types of evaporimeters were made :—

(i) The Athvale open pan type evaporimeter. This instrument consists of a circular reservoir with a side tube, the level of water in the side tube being measured by a micro-meter gauge made locally. The communication to the side tube is through a stilling orifice to cut out the disturbing effects

of wind during observations. The whole arrangement is inside a protective case filled with cello-tax boards. The instrument is exposed at a level of 4 ft. on a masonry pillar.

- (ii) The U. S. A. pattern standard evaporimeter with still-well and hook-gauge. This instrument, manufactured locally according to the U. S. A. design, has proved quite satisfactory in every way and is most useful in standardising other more portable types of evaporimeters.
- (iii) The Piche's evaporimeter. This type was used for making simultaneous observations of evaporation within different environments, e.g., in the open at different levels, inside a Stevenson screen, within different crops at different levels etc. A few locally made instruments were being standardised.

(d) *Screens for the exposure of thermometers inside crops.*—While the Assmann Psychrometer is extremely useful as a portable standard instrument for recording temperatures inside or outside crops, it is necessary for some purposes to expose a set of ordinary thermometers like those kept in the Standard Stevenson screen inside crops. The installation of a Stevenson screen permanently inside a crop is inconvenient. It is necessary to devise a light and portable type of screen which could be easily removed during cultural operations. A screen consisting of two coaxial cylinders made of heavily nickel coated metal has been designed and is under test in the observatory.

Besides the above pieces of apparatus the design of (1) a surface thermo-couple for measurement of leaf temperatures and (2) a suitable screen for housing self-recording instruments inside a crop were also in progress.

### (3) *Micro-climatology*

The study of the meteorology of the air layers near the ground was begun in India three years ago by L. A. Ramdas and collaborators. In their paper entitled "Theory of extremely high lapse-rates of temperature very near the ground"<sup>1</sup> Malurkar and Ramdas made a theoretical study of the variation of temperature with height above ground within the first metre. By taking both convective and radiation processes into consideration they showed that under steady conditions prevailing at the epoch of maximum temperature, and assuming a single effective absorption coefficient of water vapour in the long wave-length region, the temperature at a level  $z$  may be expressed as :—

$$\theta = \theta_0 \frac{\Phi \sinh \alpha(h-z)}{\sinh \alpha h}, \text{ where } \theta \text{ is the temperature in degrees}$$

absolute;  $\theta_0$ ,  $\Phi$  and  $h$  are constants and  $\alpha$  is equal to  $\sqrt{\frac{16a \sigma \theta_0^3}{k}}$

and involves the effective absorption of coefficient  $\alpha$  of water vapour per centimetre,  $\sigma$ , the Stefan-Boltzmann constant and  $K$  the thermal conductivity due to convective processes. The above expression was found to be in satisfactory agreement with observations taken above hot ground in the open on a clear afternoon. In a second paper Ramdas and Malurkar<sup>2</sup> studied the nature of the turbulence very close to a hot surface by taking photographs of the movements and showed that the surface turbulence consists of ascending conical columns of hot air thinning out as they ascended and corresponding descending columns of cold air. This pattern of ascending and descending columns is not steady but moves about in a random manner in still air. A similar state of affairs was also noticed above a warm evaporating surface of water. In the later portion of this paper the authors showed that their theoretical expression would fit in with the observed temperatures above or below a hot plate.

The thermal structure of the air layers near the ground during the night and at the epoch of minimum temperature also has been studied by Ramdas and Atmanathan.<sup>3</sup> The measurements taken during clear calm weather show that the ground surface is warmer than the air layers above it at the epoch of minimum temperature in winter

<sup>1</sup> Malurkar S. L. and Ramdas L. A. (1931), Indian Journal of Physics, 6, 495.

<sup>2</sup> Ramdas L. A. and Malurkar S. L. (1932), Indian Journal of Physics, 7, 1.

<sup>3</sup> Ramdas L. A. and Atmanathan S. (1932), Gerlands Beitrage Zur Geophysik, 37, 116-17.

and that the air temperature decreases with height at first and becomes a minimum at some height above the ground, the usual inversion itself starting from this level. In this connection another note on fog or haze at Poona by the same authors<sup>1</sup> may also be referred to. In this note the settling down of fog or haze level at Poona during the night, the elevation of its upper boundary after sun-rise in the morning and the rapid disposal of the fog or haze with the onset of diurnal convective winds have been illustrated by photographs and discussed.

With the creation of the Agricultural meteorology Branch towards the close of 1932, the investigations on micro-climatology have received a new orientation and the programme of work has included among other items, also a study of the variations of the micro-climate in different environments *e.g.*, inside and outside different crops. Since the commencement of work on agricultural meteorology, besides the other activities of a first class observatory, daily observations of air temperature and humidity (from readings of the Assmann psychrometer, smaller size) at short intervals of height up to 10 ft. above the soil have been recorded in the 'open' as well as inside the different standing crops at the epochs of maximum and minimum temperature. A large amount of very interesting information about the climate of different crops has been collected.

The systematic variations observed in different crops and the correlation of conditions in the open with those inside the crops are being discussed in a series of papers the first of which has already appeared<sup>2</sup> in the Indian Journal of Agricultural Science and the second has been submitted for publication in the same journal. In the later parts the variation of the humidity factor, the hourly variations of the micro-climates as well the dependence upon the stage of growth of the crops are being discussed. It is hoped to continue these studies with different plant densities and also extend the work to a few other representative centres so that our knowledge of the 'micro' in relation to 'micro' climate may be understood for different parts of the country. The data collected at Poona so far have proved very encouraging<sup>3, 4</sup> and one may look forward to the accumulation of still more interesting facts as the survey is extended gradually to different parts of India.

The study of the micro-climate, apart from its direct ecological value, has also added to our knowledge of the meteorology of the air layers near the ground. A few of the most important facts discovered so far are mentioned below :—

- (a) It is found that, during the clear season the surface of the ground in the open continues to be warmer throughout the night than the air layers resting upon it, that the temperature of the air falls with height up to a few centimetres and that the inversion or rise of temperature with height begins from a level between 10 to 25 cms. above the ground as has been mentioned earlier. The coolest air layer which is at some distance above the ground is not cooling by contact with the ground (for the ground is warmer) but by radiative processes which may appear to be somewhat obscure at first sight but become clearer on further investigation. This directly contradicts the usual general explanation given in meteorological literature where it is supposed that the ground cools by radiation during the night and that the super-incumbent air layers cool by coming in contact with it.
- (b) The level at which the nocturnal temperature during clear weather is a minimum is at some distance above the ground not only in the open, but also inside crops (whether irrigated or unirrigated). Whereas in the open the lowest temperatures are usually recorded at a level of about 15 cms., the corresponding level inside tall crops like jowar or sugar-cane lie between  $\frac{1}{2}$  to 1 metre above the ground. In the case of shorter crops like wheat the level of minimum temperature approximates to that in the open. It is clear therefore that these results apart from the theoretical interest which they provoke, have an important bearing on the problem of frost and its variation with height.

<sup>1</sup> Ramdas L. A. and Atmanathan S. (1932), Scientific Notes, India Meteorological Department, Vol. V, No. 54.

<sup>2</sup> Ramdas L. A., Kalamkar R. J. and Gadre K. M. (1934), Indian Journal of Agricultural Science, Vol. IV, 3, 451-467.

<sup>3</sup> "Micro-climatology" by L. A. Ramdas, "Current Science", Vol. II, No. 11, May 1934, pp. 445-447.

<sup>4</sup> "Micro-climatology in relation to crops" by R. J. Kalamkar, "Current Science", Vol. III, No. 2, August 1934, pp. 80-81.

- (c) During clear weather there is a conspicuous interchange of water vapour between the soil and the air layers near the ground *e.g.*, evaporation from soil by day causes an increase of moisture, and the absorption during night causes a decrease of moisture in the lower layers. This is indicated in the daily observations as a fall of vapour pressure with height during the day and an increase of vapour pressure with height during the night. The transition from the "evaporating" to the "absorbing" regimes in the soil surface together with the growth and decay of these phenomena have been studied in detail by taking hourly observations of all the relevant factors on typical days. These investigations are being extended to other soils as well.

After the rainy season is over, desiccation sets in during the clear season which follows; once the top of the soil has attained a stage of desiccation when its moisture content is limited by its hygroscopic properties further loss of moisture from day to day is checked although there is a conspicuous diurnal variation owing to the phenomena described above. This is shown by the behaviour of several widely differing soils, which, after reaching their respective hygroscopic stages continued to lose appreciable amounts of water by evaporation during the day but on an average recovered all the moisture so lost by absorption during the night 1, 2. Soils differ from one another so far as the intensity of these diurnal variations of their moisture content is concerned but do not show any net loss from day to day. The protection afforded to the lower layers of the soil by a desiccated surface layer is of importance in "dry farming".

- (d) Micro-climatic observations taken on a number of days just before and after sunset during clear weather and the records of the different self-recording instruments provide some interesting data to study how the effects of "radiation" and "turbulence" oppose each other so far as the stratification or stability of the air layers near the ground is concerned. Radiation in the absence of turbulence or wind movements causes very rapid cooling and stratification whereas turbulence or wind causes mixing up of air layers and a decrease in the rate of cooling and tends to prevent stratification. The relative importance of these two factors in controlling nocturnal cooling of the air layers near the ground is being examined from autographic records as well as from psychrometric observations at short intervals during the evening from 4 P.M. to 8 P.M., on selected days.

(4) *Soil Temperature in relation to soil cover*<sup>3</sup>.—The influence of the colour of the soil surface on the temperatures attained at different depths is a problem of fundamental importance. Some simple preliminary investigations which were made during the clear weather period November 1933, to April 1934, gave striking results. Two plots A and B about 8 ft. by 6 ft. each were chosen side by side in the observatory. Two similar sets of sensitive soil thermometers were installed after standardisation at depths of 0, 1, 5, 10, 15, 20, 30, 40 and 50 cms in the two plots. Simultaneous two-hourly observations were made daily after the levels of the bulbs of the thermometers had been carefully adjusted, so that exactly similar readings were obtained from both the sets of thermometers. The plot A was left undisturbed and kept as the standard plot. The plot B was given the following treatments in succession after comparative observations had been obtained for a sufficient number of days—

- (a) A very thin layer of chalk powder (white) was spread over the plot B. The temperatures of the plot B, now began falling with respect to plot A. Nearly a week had to elapse before the differences between the readings of B and A attained steady values. The temperature of B at the maximum temperature epoch were lower than those of A by as much as 10 to 15°C at 0 cm., 5 to 8°C at 5 cms., 4 to 6°C, at 10 cms., and by decreasing amounts as one went deeper into the soil. Even at the minimum temperature epoch these differences persisted at all depths excepting the surface although the magnitudes were smaller than during the day. The observations were continued for a few weeks.

<sup>1</sup> Ramdas L. A. and Katti M.S., "The variation of moisture in the surface layer of the soil in relation to the diurnal variation of Meteorological Factors", "Current Science", Vol. 3, No. 1, July 1934, pp. 24-25.

<sup>2</sup> Ramdas L. A. and Katti M.S., "Preliminary Studies on soil moisture in relation to moisture in the surface layers of the atmosphere during the clear season-at Poona". Part I, please see the forthcoming December issue of Ind. Jour. of Agri. Sc., 1934.

<sup>3</sup> Ramdas L. A. and David R.K., "Soil Temperatures", appearing in "Current Science" for December 1934.



- (b) Afterwards the thin coating of chalk was removed. The differences noticed in (a) now began to decrease, but it took about two weeks for the readings of plot B to become equal to those of A. The readings were continued for a few weeks.
- (c) The plot B was then covered with a thin layer of charcoal powder. The temperatures did not show very appreciable increase because the local soil is already sufficiently black to absorb most of the solar radiation incident on it. The readings were continued for a week and then the black layer carefully removed.
- (d) After waiting for a sufficient number of days for the temperatures of the two-plots to become equal, the effect of moistening just the soil surface with known amounts of water was next measured by recording the changes of temperature in plot B.

The above series of comparative observations were discontinued with the onset of the monsoon. They will be resumed during the next season of clear weather, when the effects of thin covers of soils from different places in India as well as the effects of a crop cover will be studied.

(5) *Studies on meteorological factors during frosty nights and methods of preventing damage to crops.*—The distribution of temperature with height at the minimum temperature epoch which was referred to earlier in the section on "Micro-climatology" refers to the temperature of the air. In addition to the temperature of the air we are also concerned, in studies on frost, with the temperatures attained by objects which are exposed to the sky during the night but are not in thermal contact with the soil. Such bodies usually radiate out more heat energy than they receive as radiation from the sky or the ground or by contact with the surrounding air. A series of "grass minimum" thermometers were therefore exposed at various levels above the ground and daily measurements of the minimum temperatures attained by them recorded every morning. These grass minimum temperatures indicate how far growing crops may cool more than the air in contact with them by radiation processes. It is noticed that the lowest temperature is recorded by the instrument at 6" or 1 ft. and not by the one nearest to the ground. This shows a parallelism to the air temperatures prevailing during the same period. The data collected so far are being examined.

It may be mentioned that during January 1934, when frost affected Poona a complete set of valuable records was obtained.

Soon after the spells of frost in January were over information regarding the intensity of the frost the attendant weather factors, the extent of the damage to different crops, the level above which the crops were affected etc., was secured by issuing a suitable questionnaire to the different agricultural officers over the affected areas in North India and the Deccan. As analysis of the weather factors as well as information collected is in hand. With a view to prepare maps showing the frequency of occasions in winter when the minimum temperature fell below certain fiducial values of temperature, the last ten years' minimum temperature data for about 50 selected stations in India were analysed. The results of these investigations will be discussed shortly.

The frost reports received from different provinces or districts in North India showed some interesting details regarding the influence of irrigation, of orchard fires etc., on the prevention of frost damage. They also revealed certain details regarding the nature of the soils where crops escaped the effects of the frost, regarding the crops which were particularly susceptible and regarding the level above which the damage was perceived. Some of the preventive methods used by the cultivators appear to be very interesting and it is intended to test them out during the coming winter.

In particular it may be mentioned that the warnings of frost arranged to be issued by the Meteorological Department to the Nasik area where grapes are grown extensively are reported to have been much appreciated by the grape growers who profited by the prior information and took some precautionary measures.

(6) *Evaporation from free water and soil surfaces.*—With a view to study the reliability and performance of different types of evaporimeters from the point of view of the 'general' as well as the 'micro' climate, comparative observations were taken four times daily with the following types of instruments :—

- (a) U. S. A. pattern standard evaporimeter (4 ft. diameter).  
 (b) Athavale evaporimeter.  
 (c) Wild's evaporimeter.

- (d) Pickering's evaporimeter.
- (e) Livingstone Atmometers (black and white).
- (f) Piche's evaporimeter.

The data so far collected are being discussed. It is observed that while (a) is very satisfactory as a standard for a head-quarters station, (b) is handier for use at sub-stations. (c) is quite satisfactory if exposed inside a Stevenson screen, but it is not useful for exposure in the open. (d) and (e) are somewhat more difficult to use in the open as there is a tendency for the upper portions to get dry during periods of drought when the evaporation is excessive; they are also difficult to keep clean in dusty weather (f) is a cheap reliable and portable type; a few of these after comparison inside a Stevenson screen may be conveniently exposed in different environments, *e.g.*, at several levels above ground in the open and similarly inside different crops etc. This is being attempted during the current clear season.

Some observations recorded during the last year with a series of Piche's evaporimeters at different levels above the ground indicated that the evaporation increases with height and particularly so at the maximum temperature epoch. This would mean that the increasing effect of wind movement on evaporation is more pronounced than that of the decrease of temperature as one raises from the ground.

#### SOIL EVAPORATION.

Three series of measurements are being made :—

- (i) The weight of the soil evaporimeter is kept constant by addition of water daily to the soil surface;
- (ii) The soil is exposed as in nature and the actual changes experienced are recorded;
- (iii) The soil is contained in a cylindrical vessel immersed through a close fitting aperture into a reservoir with a side tube. The water ascends through the soil and evaporates at the surface. The daily evaporation is measured by the diminution in weight; the water in the reservoir is filled up to a standard level marked in the side tube after measuring the previous day's evaporation.

(7) *Effective rainfall*.—A series of portable percolation gauges of the type referred to earlier, were exposed in the observatory. Simultaneous measurements of evaporation from the soil in these gauges as well as of the rainfall drained through the successive layers of the soil were made during the current monsoon season. Soils from different parts of the country were obtained and comparative observations of percolation through these soils started.

(8) *Radiation*.—Radiation is one of the most fundamental factors in meteorology as well as biology and no scheme of meteorological or biological studies would be complete without a detailed study of this factor.

Measurements of :—

- (1) intensity of solar radiation and its spectral distribution with an Angstroms-pyrheliometer, provided with a series of filters, at certain standard hours of the day;
- (2) intensity of the total radiation from the sun and the sky with the help of a continuously recording Moll's Solarigrah;
- (3) the intensity of radiation from the night sky; and
- (4) the albedo of different types of soils and surfaces of vegetation (occasionally not daily) with a Moll's sensitive thermopile were commenced about January 1934, with the help of one of the research students. The above detailed observations will make it possible to study the dependence of the climate, the micro-climate, and of the crops of a place on solar as well as of terrestrial or atmospheric radiation. Further, the complete thermal history of the air layers near the ground from day to day as well as season to season can be traced when these data are studied along with the records of other factors.

(9) *Precision observations of weather and crop*.—Agricultural Meteorology has for one of its main objects the study of weather in relation to the growth and yield of crops, the incidence of pests, diseases etc.

In the past, the information collected regarding the various factors concerned has been limited to very rough estimates of the final yield over large areas on the one hand and to certain observations on the "macro" or general climate at the few observatories of the India Meteorological Department on the other hand.

The yield data of experimental farms are, with a few exceptions, available only for short periods, but systematic climatological data have rarely been maintained. While some interesting general relationships can be established with these past data, to study crop-weather relationships in all their aspects it is necessary to collect side by side systematic detailed and uniform records of the climatic factors in the actual environment of a crop as well as of the life history of the crop during the growing season. The British Agricultural Meteorological Committee (*vide* report of the Conference of Empire Meteorologists, 1929, Agricultural Section) having realised the importance of this aspect of Agricultural Meteorology, outlined a detailed Scheme called the "Precision Scheme" with a view to record detailed observations on a few crops, according to a specified sampling technique. Our experience at Poona with the Micro-climates of different crops suggests that such a scheme, to be complete, should also include detailed observations of the micro-climate.

With a view to develop all the details a combined "Weather and crop Precision Scheme" which would be suitable for Indian conditions, has been drawn up by the Agricultural Meteorology Branch in consultation with various agricultural departments and crop specialists in India. In order to gain actual working experience of the Scheme as well as to decide upon the sampling technique suitable for Indian crops, the Agricultural Meteorological Branch also started precision observations (1) on wheat during the rabi season of 1933-34, at Poona, (2) on jowar during the current kharif season at Poona and (3) on rice during the current kharif season at Karjat. The analysis of the observations on wheat has been completed and that of jowar and rice will be taken up shortly. A discussion of these data will be made shortly. It is also hoped to extend the Precision Scheme to a few other centres.

## II.—STATISTICAL SECTION.

The Statistical Section was devoted to the following items of work :—

- (A) Analysis of the interesting data collected by the "Experimental section" with a view to accelerate the discussion of results and make them available to agricultural workers.
- (B) Analysis meteorological factors having an important bearing on agricultural problems.
- (C) Analysis of the "area sown" and "yield per acre" statistics of cotton in India in relation to the meteorological and other related factors.
- (D) Analysis of "crop yields" and meteorological factors recorded at Experimental Farms.

These items of work will be taken up one by one and the progress made during the period under review indicated briefly.

- (A) *Analysis of data collected by the "Experimental Section"*.

The data analysed consisted of :—

- (1) the daily micro-climatic data recorded at the Central Agricultural Meteorological Observatory as well as inside the various crops grown in the college farm,
- (2) periodical hourly observations of the various meteorological elements recorded with a view to bringing out the major diurnal variations in the air layers near the ground and the interaction between these layers as well as the surface layers of the soil,
- (3) the "precision records" on wheat during the rabi season of 1933-34, and
- (4) other meteorological observations such as evaporation, soil temperatures, radiation etc., and records of the different self-recording instruments like thermographs, soil thermographs, solarigraph, sunshine recorder, self-recording rain-gauge, etc.

(B) *Analysis of meteorological factors having an important bearing on Agricultural problems.*

(1) *Analysis of the dates of onset of the South-West monsoon in India.*—The date of onset of the South West monsoon is of great agricultural significance. As a preliminary to a detailed statistical examination of the subject for various parts of India the dates of onset and the nature of the distribution of the daily rainfall over the Travancore-Cochin area (where the monsoon strikes first) in the months of May and June were studied in each of the last 42 monsoons. The analysis shows interesting results. Factors which would enable these dates of onset to be predicted are being looked for.

(2) *Compilation of Frost Statistics and frequency of occurrence of various degrees of frost in India.*—Many parts of North India are liable to frost in winter. These frosts are usually associated with the clear weather which succeeds the passage of the western disturbances of this season across the country from west to east. The incidence of frost is often followed by considerable damage to crops. An attempt was made, therefore, to prepare the statistics of frost of varying degrees of intensity for the whole of India from which charts showing the frequency of occasions when the nocturnal air temperatures near the ground lay between different temperature intervals above and below the freezing point could be constructed. The minimum temperature data of about 40 selected stations and the actual grass-minimum temperature data recorded at the first class observatories of the India Meteorological Department were therefore analysed. The discussion of results is in hand.

(3) *Evaporation in India.*—The calculation of the evaporating power of the atmosphere for various parts of India, with the help of the meteorological factors, was completed and charts of evaporation over the whole of India prepared for the different months of the year. It was found that evaporation in India closely follows the march of the seasons. The light winds, weak insolation and low temperatures of the cool season causes only slight evaporation over North India; the Bombay Deccan and the adjoining tracts—with relatively greater insolation and air temperatures are areas of maximum evaporation during the winter and pre-monsoon seasons. With the advent of summer conditions, higher temperatures, greater deficiency of saturation of moisture in the atmosphere, and stronger air movements the evaporation also increases everywhere, becoming highest in April and May. The whole of the central portion of the country (the Bombay Deccan in particular) represents the area of maximum evaporation at this time of the year. When the south-west monsoon sets in with its strong moisture laden winds and heavy precipitation, the west coast of India and Burma and N. E. India experience a sudden check in the rate of evaporation; the region of maximum evaporation which lay over the Bombay Deccan also recedes towards Sind and Rajputana. During August and September the full effects of the monsoon begin to be felt in North West India also and the intensity of evaporation weakens even there. Later, with the retreat of the monsoon and the setting in of autumn in North India the evaporation "high" commences its south-ward movement towards the Bombay Deccan. In November and December wintry conditions are established. It is, however, only after other parts of India have experienced the vicissitudes of the S. W. monsoon that S. E. Madras begins to experience the effects of the N. E. monsoon and its associated rains; the moderate and steady evaporation over this area now decreases temporarily.

A chart showing the annual rainfall *minus* evaporation has also been prepared. This reveals the centres where rainfall exceed the rate of possible evaporation and those where the evaporation scores over the rainfall.

(4) *A Statistical study of the maximum temperatures at selected stations in India.*—Correlation studies with the mean monthly maximum temperatures at Poona for different months and for a period of 52 years showed that the values of successive months are highly correlated during certain seasons. The possibility of utilising such relationships for the prediction of maximum temperatures week by week was next taken up. The results have been discussed in a recent note.<sup>2</sup>

Further studies on the above lines have been continued in the case of other representative stations in India. These reveal interesting relations between the periods of high inter-monthly correlations and the seasonal changes of weather in India. The investigation is in course of completion.

<sup>1</sup> Raman P. K. and Satakopan V., "Evaporation in India calculated from other Meteorological Factors", Scientific Note, India Meteorological Department, Vol. 6, No. 61 (expected to be out shortly).

<sup>2</sup> Kalamkar R. J. "A Statistical Study of the Maximum Temperatures at Poona". Scientific Notes, India Meteorological Department, Vol. V, No. 59.

(5) *A statistical analysis of the soil temperatures recorded at Bombay.*—It is well known that soil temperature is a very important factor in plant ecology. Soil temperature data for a long series of years which could be correlated with a series of crop yield figures are very rare. At the observatory at Colaba, Bombay, daily records of soil temperatures at depths of 1", 9", 20", 60" and 132" were recorded for a period of 66 years commencing from 1860. The monthly means of the series have been statistically analysed by the polynomial method of Fisher and it is observed that significant secular changes have taken place at all depths.

(6) *Statistical analysis of rainfall of the Mysore State.*—A statistical analysis of the annual rainfall in the Mysore State and its various districts during a period of 40 years (1893-1932) was completed. The variability, secular trends, and rainfall correlations in the different districts have been worked out, and, on the basis of this above study, it has been possible to divide the State into three more or less homogenous groups with respect to rainfall. Secular trends are relatively unimportant except in Kadur district.

(7) *A statistical analysis of rainfall at Akola.*—A statistical analysis of the incidence of rainfall during the monsoon season at Akola for a period of 65 years commencing from 1868 was completed. The polynomial of the 5th degree was fitted to the 31 five-day periods of rainfall from May 22nd to October 23rd for each year. The series of six rainfall distribution constants so obtained have been further analysed with a view to investigate any progressive changes in the quantity and distribution of rainfall. The study of the relationships between Akola rainfall and crop yields of its neighbourhood remains to be done.

#### (C) *Analysis of crop and weather statistics.*

The programme of statistical investigation of past agricultural and meteorological statistics was to begin with a critical examination of the available data on the "area sown" and "yield per acre", of crops for the various districts and presidencies in India and proceed, after careful selection, to correlate some of them with the meteorological data. Accordingly the Agricultural Meteorologist got into touch with the various provincial agricultural departments with a view to collect the available Season and Crop Reports and the data of some of the experimental farms.

It was decided to make a start with the study of weather in relation to the yield of cotton in the Bombay Presidency and adjacent cotton tracts. The annual cotton yields per acre for the various districts of the Bombay Presidency for the period 1889 to 1931 were computed from the acreage and out-turn figures. The yields per acre were then correlated with rainfall and temperature after the elimination of secular trends. The regression equations between yield, rainfall and temperature were calculated. Such forecasting formulæ have been worked out for the Khandesh, Ahmednagar, Ahmedabad, Belgaum and Bijapur districts. The yield per acre of cotton is seen to be dependent, among the weather factors tried, upon the rainfall in the early and late monsoon months and the temperature in the months of September, October and November.

The influence of weather factors and prices on the acreage of cotton in the Bombay Presidency was also taken up for analysis. The investigation is being extended to the remaining important cotton tracts in India both as regards acreage and yield figures.

With a view to compare how far the indications of the crop-weather relations obtained by the correlation method support the impressions of the cultivators of different districts, a detailed questionnaire on the cotton crop was issued and the replies received from the officers of the various departments of agriculture in India. These replies are also being examined.

*Farm Data.*—(a) The results obtained from the detailed analysis of the yields of the standard wheat series at the Cawnpore Agricultural Farm were discussed in a paper entitled "A Statistical Examination of the yield of wheat at the Cawnpore Agricultural College",<sup>1</sup> and sent to the Imperial Council of Agricultural Research for publication in the Indian Journal of Agricultural Science. The correlation of the above data with the weather factors was in progress.

(b) A preliminary examination of the data received from a few other experimental farms was completed. Some of these will be taken up for detailed study in due course.

<sup>1</sup> See a forth coming paper by Kalamkar R. J., and Sripal Singh.

(D) *Statistical advice to agricultural research workers.*

This was given to numerous workers with whom the section came in contact. Particular mention may be made of the help given to the Cotton Specialist at Coimbatore who sent his measurements of temperature and humidity in fields receiving different intensities of irrigation. The method of taking "precision observations" on weather and crop was also explained to a few agricultural research workers.

## III.—GENERAL SECTION.

(a) *Co-operation with Agricultural Workers.*

The co-operation of the Agricultural Meteorology Branch was extended to the different agricultural departments or workers in the different provinces and Indian States in various ways.

(1) *Agricultural Meteorological Observatories.*—Barring a few exceptions, most of the experimental farms in India had very meagre meteorological equipment. Since the creation of the Agricultural Meteorology Branch most of the provinces or states have begun to take considerable interest in this matter, and have arranged or are arranging to equip selected farms with standard meteorological equipment as specified by the Branch. Besides rendering such advice, help was given also by training at Poona a number of agricultural workers from different parts of India in routine meteorological work as well as in micro-climatological studies, by standardising their instruments after repairing where necessary, and by giving them instructions for setting up the instruments.

Within the next few years it may be hoped that the activities of the Agricultural Meteorological Branch in this direction will result in a number of agricultural centres in different parts of the country, having uniform equipment and collecting detailed observations of weather and crops side by side in a systematic manner.

Apart from the above extension of work in systematic agricultural meteorology it may be mentioned that a number of workers in charge of the various research schemes financed by the Imperial Council of Agricultural Research discussed the meteorological aspects of their respective problems with the Agricultural Meteorologist besides getting their assistants trained, instruments standardised and observatory plants laid out. These officers sought the advice of the Branch about their special difficulties and raised many problems of interest for investigation. In this connection special mention may be made of the following :—

- (1) Dry Farming Research Schemes at Sholapur and Bijapur (Bombay Presidency), at Hagari (Madras Presidency) and Raichur (H. E. H. the Nizam's Government).
- (2) Sugar-cane Research Schemes at Padegaon (Bombay Presidency), Shahjahanpur (U. P.) and Muzafferpur (Bihar and Orissa).
- (3) Locust Research Schemes at Karachi and Pasni.

The problems relating to the conservation of moisture in the case of (1), measurement of water content in the soil and of temperatures of plants in the case of (2) and the study of Locust meteorology in the case of (3) engaged the attention of the Agricultural Meteorologist. The experience in the study of micro-climates gained by the Agricultural Meteorology Branch was of special value to all these investigators.

(b) *Collection of information by circular and questionnaires.*

In the words of Sir Napier Shaw "Agricultural Meteorology is what the farmer knows and won't say". The accumulated experience of the Indian agriculturist as adapted or interpreted by the agricultural departments of the various parts of the country is a factor which the Agricultural Meteorologist should be acquainted with. Suitable questionnaires and circulars were issued therefore to agricultural departments and officers with a view to ascertain their ideas regarding the weather requirements as well as the methods of cultivation of the cotton crop. The very valuable information which has come to hand as a result is being carefully compiled. Steps for collecting similar information about other crops are also being taken.

Other circulars with a view to collect information regarding the incidence of frost damage and to elicit suggestions on "precision observations on weather and crops" were also prepared and distributed to the agricultural officers in the country.

*Conclusion.*

The Agricultural Meteorology Branch attracted a number of research students. Six of them are working at present on different problems. The loyal and enthusiastic co-operation of these workers was responsible for the progress being made on many problems, work on which could not have been undertaken but for their assistance.

The India Meteorological Department is greatly indebted to the Imperial Council of Agricultural Research for inaugurating work on this new subject and to the Directors of Agricultural Departments and Institutions in the different provinces and States and to the various agricultural workers in the country for their valuable co-operation with the Agricultural Meteorology Branch.

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## APPENDIX XL.

NOTE DATED THE 7TH FEBRUARY 1935, BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT No. 39 :—PROPOSAL TO APPOINT PROVINCIAL DAIRY COMMITTEES.

The proposal (Annexure I) to appoint provincial dairy committees was submitted to the Advisory Board at its meeting held in September 1934 but the consideration of the subject was postponed till the next meeting of the Board so as to give time to the Provincial Directors to see how best committees of the nature proposed could be fitted in with existing provincial committees and boards dealing with livestock improvement or marketing (Annexure II).

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

## ANNEXURE I.

NOTE DATED THE 16TH AUGUST 1934, BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH ON SUBJECT No. 65 :—PROPOSAL TO APPOINT PROVINCIAL DAIRY COMMITTEE.

Attention is invited to the attached note on the subject mentioned above which has been prepared by the Animal Husbandry Expert to the Imperial Council of Agricultural Research. The subject is now for the consideration of the Board.

NOTE DATED THE 11TH AUGUST 1934, BY COL. A. OLVER, C.B., C.M.G., ANIMAL HUSBANDRY EXPERT, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON THE SUBJECT OF PROPOSED APPOINTMENT OF PROVINCIAL DAIRY COMMITTEES .

At the Provincial Economic Conference held in April 1934, general support was given to a proposal to establish Provincial Dairy Committees, and the Government of India have undertaken to address Local Governments on the matter.

The express object of the proposed Committees was to study and develop marketing arrangements and the following suggestions are put forward for consideration as to their composition and line of action.

1. They should be expert committees, under the chairmanship of the senior government official most closely concerned with the improvement of cattle in the Province and should in any case include the Livestock Officer, representative of Provincial Veterinary and Co-operative Departments, a Health Officer, and non-official representatives of the Dairy Industry in the Province.

2. Their function should be to work, in co-operation with the Marketing Officer, to induce progressive development of the production side of the industry, by improved feeding and management of dairy stock; by encouraging the preservation and registration of the approved progeny of the best milking animals; by doing everything possible to compel early castration of unsuitable sires; by organised propaganda for the systematic improvement of the supply and increased consumption of sound and clean dairy products, and by inducing Provincial and municipal authorities to insure better administrative control of the marketing of milk and dairy products.

It is not considered that these Committees should be directly concerned with the actual organisation and development of marketing, which would be the function of the Marketing Officer and his staff, but it is felt that by meeting regularly and discussing local problems affecting the industry they could do a great deal to supplement and assist the work of Marketing Officers and to strengthen the hands of provincial and municipal authorities in relation to the efficient administrative control which is essential for the development of a Dairy Industry in India on modern lines.



## ANNEXURE II.

EXTRACT FROM THE PROCEEDINGS OF THE MEETING OF THE ADVISORY BOARD HELD ON  
THE 8TH SEPTEMBER 1934.

18. *Proposal to appoint Provincial Dairy Committees. (Subject No. 65 of the Agenda).*

Col. Olver introduced the subject. Dr. Burns opposed the proposals on the grounds that most of them were not marketing work. Col. Olver explained that it was not the intention when the recommendation of the Provincial Economic Conference was accepted that these committees should carry out marketing work but that they should assist Marketing Officer by making suggestions and taking action to improve the local dairy industry. There was a good deal of discussion as to the necessity of having Provincial Dairy Committees to deal with purely dairying problems that arose out of the marketing surveys. The sense of the Board was that there was no necessity to establish such a committee in each province at this stage. Mr. Burt suggested that the question of appointing provincial dairy committees might be deferred until the next meeting of the Board as the Provincial Directors concerned might take time to consider how committees of the nature proposed could best be fitted in with existing Provincial Committees and Boards dealing with livestock improvement or marketing. The Board accepted this suggestion.

## APPENDIX XL-A.

EXTRACT FROM THE PROCEEDINGS OF THE MEETING OF THE STANDING DAIRY COMMITTEE OF THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH HELD ON THE 21ST FEBRUARY 1935.

The following were present :—

1. Col. A. Olver.
2. Mr. Zal R. Kothavala.
3. Sardar Datar Singh.
4. Mr. A. M. Livingstone.

Rai Bahadur Malik Charan Das—*Secretary.*

\* \* \* \*

*Proposal to appoint Provincial Dairy Committees. (Subject No. 39 on the Agenda of the Board).*

After considering the note circulated on the subject the Committee made the following recommendations :—

(i) The Provincial Governments should be requested to set up a Dairy Advisory Committee for the province consisting of—

- (1) The Director of Veterinary Services.
- (2) The Director of Agriculture.
- (3) The Livestock Officer of the Province.
- (4) Registrar of Co-operative Societies.
- (5) The Senior Marketing Officer.
- (6) The Director of Public Health.
- (7) Three representatives of the Dairy Industry to be recommended by the Director of Agriculture.
- (8)
- (9)

Secretarial work to be done preferably in the office of the Livestock Officer or of the person directly concerned with the development of animal husbandry in the province.

(ii) The function of this committee would be to advise Local Governments in regard to such matters as—

- (a) the institution of cattle improvement, milk recording and Cow Testing Associations;
- (b) the organisation of Clean Milk Competitions in connection with Baby Weeks, etc.;
- (c) the nature and form of legislation or regulations to be applied to milk and milk products.

The Committee further recommended that Provincial Dairy Advisory Committees should make as full use as possible of the assistance and guidance of the Imperial Dairy Expert.

\* \* \* \* \*

A. OLVER.

DELHI;

The 23rd February 1935.

## APPENDIX XLI.

NOTE DATED THE 9TH FEBRUARY 1935, BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.

SUBJECT :—*Potato breeding scheme for Northern India.*

Attention is invited to the attached note, dated the 22nd December 1934 (not printed) which was considered by the Governing Body at its last meeting in January 1935, from which it will be seen that the recommendations of the Potato Committee were approved by the Advisory Board. These have since been sanctioned by the Governing Body.

2. The Vice-Chairman considers that the following matters should now be considered by the same Sub-Committee of the Advisory Board as examined the scheme in September 1934, (i) an agreed technical programme of work in the hills (especially what varieties should be grown at the various temporary hill centres) (ii) the extent to which it is desirable that the second Imperial Economic Botanist, Dr. Pal should visit the different centres at which co-operative preliminary experiments will be conducted during 1935 and (iii) the best arrangements for supplying him with detailed information, as to the results obtained.

The composition of the Committee is as follows :—

- (1) The Vice-Chairman; Imperial Council of Agricultural Research, Chairman *ex-officio*.
- (2) The Agricultural Expert, Imperial Council of Agricultural Research.
- (3) The Director of Agriculture, Madras.
- (4) The Director of Agriculture, Bombay.
- (5) The Director of Agriculture, Bengal.
- (6) The Director of Agriculture, United Provinces.
- (7) The Director of Agriculture, Punjab.
- (8) The Director of Agriculture, Bihar and Orissa.
- (9) The Director of Agriculture, Central Provinces.
- (10) The Director of Agriculture, Assam.
- (11) The Director, Imperial Institute of Agricultural Research.
- (12) Dr. B. P. Pal, 2nd Imperial Economic Botanist, Imperial Institute of Agricultural Research, Pusa.
- (13) Professor P. K. Parija, Ravenshaw College, Cuttack.

Secretary, Imperial Council of Agricultural Research, Secretary *ex-officio*

This Committee will meet on an afternoon either on the 18th or 20th February 1935, at the Old Legislative Council Hall, Old Secretariat, Civil Lines, Delhi. The exact time and date of the meeting will be notified later. The report (please see Appendix XLI-A) of this Sub-Committee will be submitted to the Advisory Board in due course.

## APPENDIX XLI-A.

IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH ADVISORY BOARD, ELEVENTH MEETING,  
FEBRUARY 1935.

SUBJECT No. 43.

*Report of the Potato Sub-Committee on technical details of the scheme for potato research in Northern India sanctioned by the Governing Body—20th February 1935.*

## PRESENT:

Mr. B. C. Burt, Chairman,  
Mr. R. G. Allan,  
Mr. J. N. Chakravarti,  
Mr. K. McLean,  
Dr. B. P. Pal,  
Prof. P. K. Parija,  
Mr. B. S. Patel,  
Mr. J. H. Ritchie,  
Mr. D. R. Sethi,  
Dr. F. J. F. Shaw,  
Mr. H. R. Stewart.

It was agreed that the co-operative potato experiments, with a view to ascertaining at what centres potatoes flowered and fruited well, should be carried out at the following centres:—

- (1) Simla, (by Dr. Pal);
- (2) Chaubattia, United Provinces;
- (3) Allan Orchards, Ramgarh, United Provinces;
- (4) The Kulu Valley, Punjab;
- (5) Murree Hills, Punjab; and
- (6) The Shillong Farm, Assam.

All arrangements for these experiments will be made by the Departments concerned. The sanction to the grant of Rs. 500 to each centre has already been conveyed to Local Governments.

2. As regards the varieties to be grown, it was agreed that 60 lbs. would be required to enable 10 lbs. to be supplied to each centre from one common stock which is essential. Dr. Pal undertook to supply Pusa White (Desi), Coonoor White, Late Car-man, President and Majestic. The Director of Agriculture, United Provinces, can supply the necessary quantity of a number of varieties as can the Director of Agriculture, Punjab, and possibly the Director of Agriculture, Bengal. These Directors have promised to send in a list and from these duplicates will be eliminated and a final list drawn up in the Council's office. This final list will be supplied to each supplying centre which will make arrangements for the direct supply to all other centres. Potato tubers for Simla should be despatched to the Assistant in charge, Rust Research Laboratory, Flowerdale, Simla, E., by passenger train, carriage paid all varieties to be carefully labelled, and those for other centres as shown below:—

Centre	Tubers to be addressed to	To be despatched by
Chaubattia	Superintendent, Government Gardens, Chaubattia	Passenger train,
Allan Orchards	Manager, Allen Orchards, Ramgarh, Bhowali (via Kathgodam)	Do. do.
Kulu Valley	Agricultural Assistant, Kulu	Parcel post.
Murree Hills	Deputy Director of Agriculture, Rawalpindi	Passenger train.
Shillong Farm	Manager, Shillong Farm, Shillong	Do. do.

*N.B.*—All consignments to be sent *carriage paid* in order to secure the concession rates and all varieties should be carefully labelled.

3. The Sub-Committee desires that, as far as possible, sowings should be made at different dates at each centre in order to find out the best time for planting for seed production purposes.

4. The following detailed information will be required :—

- (1) Date of flowering (first, maximum and last),
- (2) Number of flower clusters per plant.
- (3) Number of berries set per plant. All berries should be sent to Dr. Pal when mature.

5. In addition, Simla and Chaubattia will carry out observations on potato flowers and the presence of fertile pollen. It was agreed that Dr. Pal should pay one visit to each station other than Simla during the flowering season and he will of course pay more frequent visits to Simla.

6. It was agreed that Dr. Pal should correspond direct with the following provincial officers :—

*Punjab*.—Khan Sahib Chaudhri Ali Muhammad, Oilseeds Specialist, Lyallpur,

*United Provinces*.—Dr. Dey, Agricultural College, Cawnpore, (both in regard to Chaubattia and Allan Orchards),

*Shillong*.—The Director of Agriculture.

7. The Director of Agriculture, Shillong, can supply the required quantity of tubers of two varieties, viz., "Factor" and "Windsor Castle". Any material for planting at Shillong must be despatched as quickly as possible, because potato planting takes place up to the middle of March.

8. Dr. Pal informed the Committee that 140 samples of different kinds of potatoes have been collected from all over India and are under systematic study at Pusa. Thirteen varieties had flowered, three had formed berries and one had fruited very freely at Pusa. Of the material received from Dr. Hudson, 52 lots of three different species had survived. Of the five lots of Russian seed, four had germinated—three quite well—one had not germinated.

B. C. BURT.

DELHI :

The 20th February 1935.

## APPENDIX XLII.

NOTE DATED THE 11TH FEBRUARY 1935, BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT NO. 44:—RECONSTITUTION OF THOSE SUB-COMMITTEES OF THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, APPOINTED UNDER RULE 30, WHICH HAVE BEEN IN EXISTENCE FOR TWO YEARS OR MORE.

At its meeting held in February, 1934, the Advisory Board considered the question whether the period of membership of the sub-committees appointed by the Governing Body under Rule 30 of the Rules and Regulations of the Council, should be fixed and if so, whether this should be done by an amendment of the Rules and Regulations or whether the Governing Body should provide for this under the powers vested in it under Rule 30.

The Board recommended that the Governing Body be asked by resolution to fix the period of membership to two years.

The following draft resolution was therefore submitted for the consideration of the Governing Body and was approved by it at its meeting held on the 22nd January, 1935:—

“Resolved that members of Sub-Committees appointed by the Governing Body, Imperial Council of Agricultural Research, under Rule 30 of the Rules and Regulations of the Council shall relinquish their membership on the expiry of two years from the date on which they became members of the Sub-Committees, but shall be eligible for re-appointment to them”.

2. The Governing Body also approved of the proposal that the question of re-constituting all the Sub-Committees appointed under Rules and Regulations 30 which have been in existence for 2 years or more be submitted before the Advisory Board at its meeting to be held on the 18th to 23rd February, 1935, and thereafter the Board's recommendations be circulated to the Governing Body for orders. Accordingly a list of all such Sub-Committees, viz., (1) Sugar Committee, (2) Fertilizers' Committee, (3) Indian Oil Crushing Industry Committee, and (4) Locust Committee, with the information regarding the names of members and the dates of their appointment to the Committees concerned, is enclosed.

3. The question of reconstituting these Committees is now for the consideration of the Advisory Board.

*Statement furnishing information regarding the names of members, etc., of the Sub-Committees appointed by the Governing Body under Rule 30 of the Rules and Regulations of the Imperial Council of Agricultural Research.*

## SUGAR COMMITTEE (ORIGINAL MEMBERS).

Personnel.	Date of Appointment.
1. Diwan Bahadur Sir T. Vijayaraghvacharya, K.B.E., Vice-Chairman to the Council—Chairman . . . . .	23rd Sept. 1929.
2. B. C. Burt, Esq., C.I.E., M.B.E., B.Sc., I.A.S., Agricultural Expert to the Council . . . . .	Do.
3. Chowdhri Mukhtar Singh (then M. L. A.), (Now Daurala Sugar Works) . . . . .	Do.
4. Mr. Walchand, Hirachand . . . . .	Do.
5. The Director of Agriculture, Madras . . . . .	3rd October 1932 <i>Ex officio.</i>
6. Agricultural Chemist to the Government of Bengal as representative of that Government (On leave for one year from October, 1934, the Government of Bengal have nominated Mr. Gosto Behari Pal, Assistant Agricultural Chemist, as a substitute) . . . . .	24th October 1934.

\*Rule 30.—The Governing Body may by Resolution appoint Sub-Committees for such purposes and with such powers as the Governing Body may think proper.

Personnel.	Date of Appointment.
7. Director of Agriculture, United Provinces . . . . .	23rd September 1929 <i>Ex-officio.</i>
8. Khan Bahadur Fatehuddin, B.A., M.R.A.S. (E.) A.R.H. S., I.A.S., Deputy Director of Agriculture, Punjab . . . . .	23rd Sept. 1929.
9. The Director of Agriculture, Bihar and Orissa . . . . .	Do.
10. Dr. W. McRae, M.A., D.Sc., of the Imperial Institute of Agricultural Research, Pusa. (He has since retired from service and the question of appointing a substi- tute is under consideration) . . . . .	Do.
11. Rao Bahadur T. S. Venkataraman, Sugar-cane Expert, Coimbatore . . . . .	Do.
12. The Director of Agriculture, Mysore . . . . .	4th November 1933.
13. Lala Har Sehaj Gupta, Zamindar, Belari, United Pro- vinces (also sugar manufacturer) . . . . .	23rd September 1929.
14. Sardar Bahadur Sir Sunder Singh Majithia, Zamindar, Punjab . . . . .	Do.

With power to co-opt.

*Co-opted Members.*

1. Seth Haji Abdulla Haroon, M. L. A. (Concern and Sugar Factory, Bihar) . . . . .	28th January 1930
2. Mr. J. J. Miller, Manager, Belapur Sugar Factory, Belapur, P. O. Harigaon (District Ahmednagar) . . . . .	Do.
3. Mr. Saranghar Das, The Ziawadi Sugar Factory, Ziawadi, Burma . . . . .	Do.
<i>Nominated by the Indian Sugar Producer's Association—</i>	
4. Mr. Noel Deerr, Messrs. Begg Sutherland & Co., Cawn- pore. Sugar Technologist) . . . . .	Do.
5. Mr. F. A. Sherwani, Messrs. Bashir & Co., Aligarh. (Sugar Factory Proprietor) . . . . .	Do.
6. Khan Bahadur Sayed Mohammad Hadi (Then Director of Agriculture, Bhopal) since retired from service . . . . .	Do.
7. Lala Hari Raj Swarup, Rais, and Sugar Factory Proprietor, Rambagh, Muzaffarnagar . . . . .	7th December 1931.

*Nominated by the Indian Sugar Mills Association—*

8. Lala Shri Ram, Daurala Sugar Works, Daurala. (Meerut District) . . . . .	22nd April 1933
9. Mr. D. R. Narang, The Basti Sugar Mills Co., Ltd., Basti. (B. N. W.) . . . . .	Do.

The Secretary, Imperial Council of Agricultural Research,  
is Secretary *ex-officio*.

The Sugar Technologist, Imperial Council of Agricultural  
Research, attends all meetings.

*Fertilisers' Committee.*

The Vice-Chairman, Agricultural Expert and Secretary, Imperial Council of Agricultural Research, <i>ex-officio</i> . . . . .	22nd May 1930.
1. The Director, Imperial Institute of Agricultural Research, Pusa . . . . .	Do.
2. The Agricultural Chemist, Bombay . . . . .	Do.
3. Rao Sahib B. P. Vagholkar, Bombay . . . . .	Do.
4. The Agricultural Chemist, Punjab . . . . .	Do.

Personnel.	Date of Appointment.
5. The Director of Agriculture, Punjab . . . . .	22nd May 1930.
6. The Director of Agriculture, Madras . . . . .	Do.
7. Rao Bahadur B. Viswanath, Agricultural Chemist to the Government of Madras. (Now Imperial Agricultural Chemist, Pusa) . . . . .	Do.
8. Mr. M. Carbery, Bengal. (Now on leave) . . . . .	Do.
9. Dr. Sen (of the Imperial Institute of Agricultural Research, Pusa). He has since retired and his post has been filled up by Rao Bahadur B. Viswanath . . . . .	Do.
10. Dr. L. K. Hyder . . . . .	Do.
11. Mr. D. R. Sethi, Director of Agriculture, Bihar and Orissa . . . . .	Do.
12. Dr. S. B. Singh, Deputy Director of Agriculture, United Provinces . . . . .	Do.
13. Mr. P. H. Carpenter, Assam . . . . .	Do.
14. Mr. B. C. Burt, C.I.E., Agricultural Expert to the Council, <i>ex-officio</i> . . . . .	Do.
15. The Director of Agriculture, Burma . . . . .	Do.
16. The Agricultural Chemist, Burma . . . . .	Do.
17. The Director of Agriculture (Mr. J. H. Ritchie), Central Provinces) . . . . .	6th November 1933.
18. Mr. V. Ramdas Pantulu . . . . .	22nd May 1930.
The Vice-Chairman and the Secretary of the Council being the <i>ex-officio</i> Chairman and Secretary, respectively, of the Committee . . . . .	Do.

*statement showing the names of members, etc., of the Sub-Committee appointed by the Governing Body under Rule 30 of the Rules and Regulations of the Imperial Council of Agricultural Research.*

*Indian Oil Crushing Industry Committee.*

	Date of Appointment.
1. Diwan Bahadur Sir T. Vijayaraghavacharya, K.B.E., Vice-Chairman of the Imperial Council of Agricultural Research—Chairman . . . . .	17th April 1931.
2. B. C. Burt, Esq., C.I.E., M.B.E., B.Sc., I.A.S., Agricultural Expert to the Council . . . . .	Do.
3. Mr. S. D. Saklatvala (Bombay) . . . . .	Do.
4. Mr. W. Roberts, B.Sc., C.I.E. (Punjab) . . . . .	Do.
5. Mr. A. Kesava Menon, B.A., F.C.S. . . . .	Do.
6. Mr. J.A.H. Dube, Director of Industries, U.P., Cawnpore . . . . .	Do.
7. Mr. R. M. Gandhi, B.A. . . . .	Do.
8. Haji Abdulla Haroon, M. L. A. . . . .	Do.
9. Mr. J. H. Walker, A.R.T.C., A.I.C. . . . .	Do.
10. Sh. Mohammed Ismail of Messrs. Shah Mohammed Ismail and Maula Bux . . . . .	Do.
11. Mr. G. A. Mahamdi . . . . .	5th November 1931.
12. Dr. R. L. Datta, D.Sc., F.R.E. . . . .	16th December 1932.



atement showing the names of members, etc., of the Sub-Committee appointed by the Governing Body under Rule 30 of the Rules and Regulations of the Council.

*Locust Committee.*

	Date of Appointment.
1. Diwan Bahadur Sir T. Vijayaraghavacharya, K.B.E., Vice-Chairman of the Council.	..
2. Mr. B. C. Burt, C.I.E., M.B.E., Agricultural Expert to the Council.	..
3. The Entomologist to the Government of the United Provinces . . . . .	29th January 1930.
4. P. W. Marsh, Esq., C.I.E., I.C.S., Commissioner, Meerut .	Do.
5. Imperial Entomologist, Imperial Institute of Agricultural Research, Pusa . . . . .	30th January 1930.
6. Director of Agriculture, Punjab, Lahore . . . . .	29th January 1930.
7. Entomologist to the Government of the Punjab . . . . .	Do.
8. Director of Agriculture, Bombay, Poona . . . . .	Do.
9. The Lecturer in Entomology, Agricultural College, Poona	Do.
10. The Assistant Chief Agricultural Officer in Sind, Karachi	Do.
11. Rao Bahadur Mani Lal K. Kajo, Assistant Secretary to the Agent to the Governor General, Western India States, Rajkot . . . . .	30th January 1930.
12. Chief Agricultural Officer, N.-W. F. P. . . . .	29th January 1930.
13. Mr. Dible, I.C.S. (He attended the first meeting in the capacity as Collector, Muttra).	
14. Mr. C. L. Corfield, I.C.S. . . . .	30th January 1930.
15. The Secretary, Imperial Council of Agricultural Research— Secretary <i>ex-officio</i> .	

## APPENDIX XLIII.

NOTE DATED THE 16TH FEBRUARY 1935, BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT No. 45 :—PROPOSALS FOR THE INITIATION OF FUTURE RESEARCH INTO THE INSECT PESTS OF SUGARCANE.

The attached copy of a note dated the 22nd December 1934 (not printed), on the above subject, which was circulated to the Governing Body, in connection with its meeting held in January 1935, is for the information of the Advisory Board. Relevant extracts from the proceedings of the Governing Body are reproduced below :—

“The Vice-Chairman explained that the subject was for the information of the members at the moment. It would be placed before the Governing Body when detailed proposals were received from the Director, Imperial Institute of Agricultural Research. This was noted”.

A revised scheme on the lines mentioned in the note is now under preparation and will be submitted to the Board at a subsequent meeting.

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## APPENDIX XLIV:

NOTE DATED THE 7TH FEBRUARY 1935 BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT No. 46 :—APPOINTMENT OF PROVINCIAL COMMITTEES FOR THE DEFINITION OF BREED CHARACTERISTICS.

Attention is invited to the recommendation on item No. 4 (Annexure I) of the agenda for the first meeting of the Cattle Breeding Committee held in February 1934. Following this recommendation a circular letter was addressed to all Provincial Governments (Annexure II) asking for information regarding the characteristics of breeds that are considered worthy of registration and the replies are awaited.

2. It is for the consideration of the Advisory Board whether, in order to make the definition of breed characteristics authentic, it would not be desirable to appoint special, *ad hoc*, Provincial Committees for the purpose.

3. The subject will first be considered by the Standing Cattle Breeding Committee and its recommendations will be placed before the Advisory Board in due course.

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## ITEM NO. 4 (ANNEXURE I).

\* EXTRACT FROM PROCEEDINGS OF THE FIRST MEETING OF THE CATTLE BREEDING COMMITTEE OF THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH HELD AT NEW DELHI ON THE 19TH FEBRUARY 1934.

4. In regard to the Animal Husbandry Wing Meeting resolution on subject No. 11 and subjects Nos. 2 and 4 of the Agenda, the Committee strongly recommended that a system of registering and marking approved cattle, similar to that adopted in the Bombay Presidency and to some extent in the Punjab, should be generally adopted in India, to enhance the market value of carefully bred stock produced by breeders in the country. They further considered that the first step in establishing all-India pedigree records would be to carry out an all-India survey to decide (a) which of the so-called breeds at present in existence are valid breeds and worthy of organized development, and (b) to decide on an official definition of the breed characteristics of each breed which it is proposed to recognise.

5. They suggest that the Animal Husbandry Expert to the Imperial Council of Agricultural Research be requested to put up a scheme for this work to be undertaken under a grant from the Imperial Council of Agricultural Research.

## ANNEXURE II.

COPY OF A CIRCULAR LETTER NO. D-1061/34/VET., DATED THE 11TH DECEMBER 1934 FROM THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH TO ALL LOCAL GOVERNMENTS (INCLUDING CONSTITUENT INDIAN STATES; OF IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, i.e., MYSORE, BHOPAL, BARODA, HIS EXALTED HIGHNESS THE NIZAM'S GOVERNMENT, TRAVANCORE AND COCHIN.)

SUBJECT :—*Establishment of Pedigree Herd Books in India.*

I am directed to address you on the above subject and to say that the Animal Husbandry Wing of the Board of Agriculture and Animal Husbandry in India resolved at its first meeting held at New Delhi in February 1933 (Subject No. 11 of the agenda) that All-India Herd Books should now be established in the case of a few well known dairy breeds commencing with the breeds at present maintained on Government Farms and other Institutions where reliable records are kept. In the case of other breeds the Board recommended that provincial herd registration, with the object of emphasising the value of Pure Bred animals, should precede the more detailed individual records usually maintained for pedigree stock.

2. The Standing Cattle Breeding Committee of the Imperial Council of Agricultural Research, which went further into the question at its meeting held in February 1934, considered that the first step in establishing pedigree registers would be to carry out an all-India survey to decide (a) which of the present so-called breeds are valid breeds and worthy of organised development, and (b) to decide on an official definition of the breed characteristics of each breed which it is proposed to recognise.

3. To implement the above resolutions, and as a preliminary step in the establishment of all-India herd books, it is proposed that the Imperial Council of Agricultural Research should bring out brochures defining as accurately as possible the main breed characteristics of the principal Indian breeds of livestock. I am to request the Government of to furnish this Department with information under the following heads in regard to those breeds of their Province/State which are considered worthy of registration as pure indigenous breeds. To make this information authentic it is considered that the matter should be dealt with by expert Provincial/State Committees of which representatives of Provincial/State veterinary departments and prominent livestock breeders should be members in addition to Provincial/State Livestock Experts, where such exist :—

- (1) The best height, weight and girth of typical animals and the limits within which deviation may be permitted.
- (2) The optimum and permissible deviation of measurements below the knee.
- (3) The accepted colours and markings and any special points of external conformation, particularly of head and horn.

- (4) A careful description of the conformation of the best type from a strictly utilitarian point of view.
- (5) Any special characteristics typical of the breed.
- (6) The average milk yield and, if available, information as to maximum daily yields, fat percentages, days in milk and frequency of calvings under (a) village conditions, (b) special conditions obtaining in well managed farms.  
*N.B.*—Any remarkable performances of individuals or herds may be referred to separately.
- (7) Photographs of typical male and female representatives at different ages.
- (8) Any other point or points which it is considered advisable to emphasise.

4. The information, when obtained from provinces and States will be collated by the Imperial Council of Agricultural Research for publication after consideration by a special committee and I am to add that the Council would be grateful for any suggestion which the Government of \_\_\_\_\_ may offer on the subject.

## APPENDIX XLIV-A.

EXTRACT FROM THE PROCEEDINGS OF THE MEETING OF THE CATTLE BREEDING COMMITTEE OF THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH HELD ON THE 21ST FEBRUARY 1935.

The following were present :—

1. Col. A. Olver.
2. Mr. T. F. Quirke.
3. Mr. E. J. Bruen.
4. Mr. T. Egan.
5. Mr. C. R. Parr.
6. Mr. P. J. Kerr.
7. Mr. F. Ware.

Rai Bahadur Malik Charan Das, Secretary.

2. *Appointment of provincial committees for the definition of breed characteristics.*  
(Subject No. 46 on the Agenda of the Board).

After discussion it was agreed that to carry out this work properly it was essential to have a specially selected officer with wide knowledge of the different breeds of cattle in India who would carry out a survey of the breeds which it is proposed to recognise, in collaboration with breeders and others who have local knowledge of these breeds. It was recommended that such an officer should be employed for a term of five years and attached to the Animal Husbandry Bureau of the Imperial Council of Agricultural Research. It was proposed that the reports made by this officer on the different breeds should be considered by the Standing Cattle Breeding Committee, and that an authoritative definition of the characteristics of each breed should eventually be issued for guidance by the Imperial Council of Agricultural Research. The decision as to the breeds to be dealt with in the first instance should be made by the Animal Husbandry Expert after replies have been received from the provinces to the letter which has been addressed to them on the subject.

A. OLVER.

DELHI;

The 22nd February 1935.

## APPENDIX XLV.

NOTE DATED THE 10TH FEBRUARY 1935 BY THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ON SUBJECT NO. 48 :—PROPOSAL FOR THE APPOINTMENT OF A DISEASE INVESTIGATION OFFICER FOR SIND AND AJMER-MERWARA.

When the proposal to appoint Disease Investigation Officers in the Provinces was under discussion it was decided that as Sind belonged to the Bombay Presidency it should not be treated separately. Consequently a Disease Investigation Officer was not appointed, but as it is now understood that Sind is to be separated and special arrangements are being made for special provision for Sind with this eventuality in view the Animal Husbandry Expert to the Council recommends that a Disease Investigation Officer should now be allotted to the Superintendent, Civil Veterinary Department, Sind, for that province, for veterinary investigation work in Sind and Ajmer-Merwara which is also under his control.

Funds will have to be provided for the officer to be appointed in Sind on the same scale as for a province, i.e., Rs. 50,000 for a period of five years.

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