



INDIAN CENTRAL JUTE COMMITTEE

Proceedings of the Eleventh Meeting

OF THE

JUTE CENSUS COMMITTEE

HELD ON

the 5th September, 1940.

Calcutta:

1940

TABLE OF CONTENTS.

	PAGES.
1. AGENDA	
2. PROCEEDINGS OF THE MEETING	1-4
3. PAPERS CIRCULATED	
(i) SUBJECT NO. 46 ... APPENDIX I ...	5-13
(ii) SUBJECT NO. 47 II ...	14-49
(iii) SUBJECT NO. 48 III ...	50-51
(iv) SUBJECT NO. 49 IV ...	52-56

AGENDA FOR THE ELEVENTH MEETING OF THE
JUTE CENSUS COMMITTEE HELD ON THE 5TH
SEPTEMBER, 1940.

1. To confirm the proceedings of the Tenth Meeting of the Census Committee held on the 25th July, 1940.

2. To consider the Report of the Field Section of the Sampling Census of Jute, 1940.

3. To consider the preliminary Statistical Report by Prof. P. C. Mahalanobis of the Sampling Census of Jute, 1940.

4. To consider the Programme of work in connection with the Provincial Survey in 1941 for Sampling Census of Jute.

5. To consider the final revised budget estimates of the Scheme for the Improvement of Jute Forecast for 1940-41 and budget estimates for 1941-42.

D. L. MAZUMDAR,

Secretary.

PROCEEDINGS OF THE ELEVENTH MEETING OF
THE JUTE CENSUS COMMITTEE HELD AT
CALCUTTA ON THE 5TH SEPTEMBER, 1940.

PRESENT :

1. W. A. M. Walker, Esq., *Vice-President, (In the Chair).*
2. P. M. Kharegat, Esq., C.I.E., I.C.S., *Member.*
3. H. P. V. Townend, Esq., C.I.E., I.C.S., *Member.*
4. Rai Bahadur N. C. Sen, *Member.*
5. Prof. P. C. Mahalanobis, *Member.*
6. H A. Luke, Esq., *Member.*
7. P. N. Sen, Esq., *Member.*
8. D. L. Mazumdar, Esq., I.C.S., *Member and Secretary.*

Mr. S. K. Banerji, Field Supervisor, was also present at the meeting.

To confirm the proceedings of the Tenth meeting of the Jute Census Committee held on the 25th July, 1940.

The proceedings were confirmed.

SUBJECT NO. 46.—*To consider the report of the Field Section of the Sampling Census of Jute, 1940. (Appendix I.)*

Mr. Sen suggested that the survey figures given in the report should be shown in acres.

Mr. Townend held that in certain cases it was more convenient to have the figures in square miles, especially where district areas were concerned, while areas under jute should be shown in acres.

It was agreed that henceforward figures of jute area should always be given in acres and in other cases they should be given both in square miles and in acres, wherever this could conveniently be done.

In reply to Mr. Townend, Prof. Mahalanobis said that the omission of some areas because maps were not available was immaterial because their percentage to the total area was very small, and so it did not affect the random character of the experiment. The omission of *char* lands and of areas abandoned for making provision for crop-cutting experiments was in accordance with theory.

Regarding the supply of maps, the Director of Land Records and Surveys pointed out that next year his Department would require a large number of maps and it would not be possible for him to ensure a regular supply of maps to the Committee for their work, unless early notice of requirements was given.

Prof. Mahalanobis said that he would try to inform the Director in good time of his requirements so that new maps might be printed where practicable.

The Report was adopted.

SUBJECT NO. 47.—*To consider the Preliminary Statistical Report by Prof. Mahalanobis of the Sampling Census of Jute, 1940, (Appendix II.)*

Prof. Mahalanobis explained that the present report was only of a preliminary nature dealing with figures for only 18,412 sq. miles out of a total of 20,900 sq. miles to be tackled and in his next report he would give the full results of the whole of the area in question. The differences between the area under jute as worked out by Prof. Mahalanobis and those given in the Government forecasts were then discussed.

The Chairman considered that the actual acreage this year was less than that given in the Preliminary Government forecast and if the figures given by Prof. Mahalanobis were accepted, it meant that either we would have an outturn of 160 lakhs of bales against 125 lakhs estimated by the trade or that the average outturn per acre was less than what had usually been accepted.

Mr. Luke pointed out that if the figures were accepted, the yield per acre would be only 2·4 bales which he thought was absurd.

He further said that in the districts where there was a big difference between the actual acreage and the total area of the district, the discrepancy was the widest, while it was less in those districts which had been completely surveyed.

The Chairman however pointed out that even in the districts of Tippera and Mymensingh which had been completely surveyed there was a discrepancy of no less than 25 or 30 per cent.

The Secretary stated that the low density of cultivation in Nadia, Jessore and Rajshahi might have something to do with the percentage figures.

Prof. Mahalanobis explained that in certain districts only a portion of the area had been surveyed in time to be taken into account. In these cases they had concentrated first on areas where cultivation was more intense. The total acreage under jute worked out on that basis naturally gave a higher acreage than the actuals and it would probably be found when his survey was complete that the acreage was less than any which could be estimated on the basis of the incomplete data available. He considered it quite likely that the areas in Tippera and Mymensingh would actually be much higher than had been estimated in the forecast.

Regarding area extraction, Prof. Mahalanobis explained that it was necessary to obtain the area of each individual plot included within the sample units before tabulation of the primary material could begin. So far they had been measuring the area of only those plots which were under jute, and their work of area could not begin till after they had secured the field *khasras*. If the results were to be ready in time to be a check on the forecast, it was essential to extract the area of all the plots included within the field survey before the field records were due to come back to the Laboratory; from lists prepared of these areas, it would be possible to get out conclusions about the areas under jute within a week or so.

As regards the optical experiments, Prof. Mahalanobis said that this year they had to handle 56,000 mouza maps and, next year, he estimated, they would have to handle 1,25,000 individual sheets of maps. This would in practice be a very difficult matter. Also the laboratory would require fresh maps from time to time

and the expense would not be negligible. In order to avoid the difficulty of handling maps and to save expense, he preferred to take micro-photos on cinema films of the mouza maps, to project them through grids on a screen and to work on them. That would save a large amount of cost. Preliminary experiments had found that trained men could by this method readily locate the random points and extract the areas: what he wanted to discover was whether this could be done even by comparatively untrained men. If this proved to be possible, it would save the recurring cost of the maps and greatly facilitate the work.

After further discussion, the proposals suggested by Prof. Mahalanobis were approved.

SUBJECT NO. 48.—*To consider the Programme of work in connection with the Provincial Survey in 1941 for Sampling Census of Jute. (Appendix III.)*

The Chairman said that the whole matter was summed up in the Secretary's note, and they could accept the programme.

The programme of work was approved.

SUBJECT NO. 49.—*To consider the revised budget estimates of the Scheme for the Improvement of Jute Forecast for 1940-41 and budget estimates for 1941-42. (Appendix IV.)*

The revised budget estimates for 1940-41 were approved.

Regarding the budget estimates for 1941-42, it was decided that the budget estimates be recommended to the Main Committee provisionally and that they should be scrutinised by this Committee (Jute Census Committee) at a meeting to be held after the Puja holidays.

The meeting then terminated.

D. L. MAZUMDAR,

Secretary,

The 5th September, 1940.

Indian Central Jute Committee.

APPENDIX I

NOTE BY THE SECRETARY DATED 23RD AUGUST, 1940, ON SUBJECT NO. 46.—*To consider the Report of the Field Section of the Sampling Census of Jute, 1940.*

A copy of the report on the Field Work of the Exploratory Sample Census of Jute, 1940, submitted by the Field Supervisor, is attached (enclosure) for the information of the members of the Committee.

2. The Field Survey of all the eight districts which was started in the first week of May has now been completed. The actual work undertaken covered an area of 20,500 square miles, out of a total of about 24,000 square miles. In spite of many difficulties connected with the recruitment, training and control of such a large staff the work has been carried out smoothly and completed in good time. The credit for the satisfactory issue of the Field Work goes to the Supervisor and to the field staff employed under him.

ENCLOSURE

*Report on the Field-work of Exploratory Sample
Census of Jute, 1940.*

1. THE PROGRAMME:

The Jute Census Committee at its meeting of the 10th October, 1939, decided that an Exploratory Sample Census would be carried out in 1940 on a much wider scale than what had been attempted before. The area surveyed in 1939 was about 2,300 sq. miles. This year's programme comprised about 24,000 sq. miles or more than ten times the last year's figure. It embraces the eight main jute-growing districts of Bengal, namely, Jessore and Nadia in the Presidency Division, Rajshahi, Bogra and Rangpur in Rajshahi Division, Dacca and Mymensingh in Dacca Division, and Comilla in Chittagong Division. These eight districts represent nearly three-fourths of the jute area of the province.

2. THE PHYSICAL FEATURES AND NATURAL FACTORS:

It is hardly necessary to dwell at length on the physical and natural features. The broad geographical outlines and physical characteristics of the area under review will be apparent from any relief map of this deltaic province. The numerous Khals, bills, rivers and lagoons dotted throughout the area and particularly in East Bengal while helping luxuriant growth of crops create none the less problems of communications and quick movement of the field-worker. The sudden rise of water in the snowed rivers due to the melting of snows in the mountains is another factor to reckon with. The Nor'-wester of April-May and lastly the Monsoon of June-August create additional problems for field work. These, in brief, are the geographical and natural factors that go to make up the physical background of the Scheme.

3. THE PREPARATORY STAGE:

During the off-season of 1939—from mid-October, 1939, to March, 1940—a few workers under a Chief Inspector were engaged in collecting maps from District Record Rooms and also in gathering such local information, as, the approximate time of sowing and harvesting, possible camping places and so on.

4. THE START:

The Assistant Supervisor who is a Statistical Assistant of the Committee, was released for this work on the 27th March, 1940. The Supervisor assumed charge on the 3rd April, 1940. As it was already late by then, much lee-way had to be hurriedly made up in respect of essential preliminaries of the operation, for example, the marking out of Blocks, the drawing up of programmes and the printing of various forms. The printed "Khasra" forms alone numbered 66,000. The mauza maps which were left over in district headquarters were brought down to Calcutta and fifty thousand maps were arranged according to the requirements of the plan of the Scheme.

5. THE STAFF:

Fifteen Agricultural Overseers with their peons and sixty Agricultural Demonstrators of the Committee who usually work under the Director of Agriculture were available for the work. They were posted mainly to the districts where they were already employed. An additional temporary staff of 172 Investigators, 19 Inspectors and 6 Chief Inspectors were appointed.

Out of the appointed staff 41 Investigators and 2 Inspectors did not join at all and fresh recruitments had to be made in their place. In consequence of this, 7 out of 32 Field-units could not be started before the second week of May.

Five Agricultural Demonstrators did not join in time. One of them joined only on the 25th June to be transferred back 7 days after when the work of his unit was completed. Substitutes had to be engaged in their places and the substitutes were discharged when they joined.

During the period of 3½ months of Field-work 32 Investigators, 2 Inspectors and 1 Chief Inspector resigned their posts. 20 Investigators and 2 Inspectors were granted leave on medical grounds for more than a week. Much difficulty was often felt in the recruitment of the proper type of workers, or in training them up.

6. THE DIVISIONS:

The entire area was divided into 6 Blocks and 21 Sub-Blocks, conforming more or less to the usual administrative boundaries. The big district of Mymensingh, was however, divided into two Blocks following the course of the Brahmaputra.

A pair of Inspectors each with his party of Investigators numbering 6 to 8 were placed in charge of a Sub-block, while 2 or 3 Sub-blocks made up a Block, the charge of a Chief Inspector.

7. THE FIELD WORK :

The regular work commenced starting in the different districts about the first week of May. The Investigator was provided with maps and Grid-lists. He had to visit the spot of the Grid and record results of his enquiry in Khasras. About 80 per cent. of the Grids measured 4 acres in size, while the remainder varied from 2·25 to 9 acres.

The actual Field work undertaken covers an area of 20,500 sq. miles, out of a total of 24,000 sq. miles, or, in other words, about 14 per cent of the area was curtailed. Some saving in the Budget is expected and according to the decision of the Jute Census Committee on the 25th July, 1940, a part of the saving would be utilised for crop-cutting experiments to ascertain the Field-factors.

An account of the Number of Grids allotted and investigated and dates of completion of field work is given below :—

Districts.	No. of Grids allotted.	No. of Grids investigated	Date of completion of field work.
Nadia ...	1,502	1,485	10-7-40
Jessore ...	2,562	2,532	28-7-40
Rajshahi ...	1,974	1,935	18-7-40
Bogra ...	3,605	3,591	30-7-40
Rangpur ...	2,770	2 758	25-7-40
Mymensingh ...	16,210	16 075	18-7-40
Dacca ...	6,524	6,375	10-7-40
Comilla ...	6,364	6,273	15-7-40
	41,511	41,024	

About 500 Grids could not be worked upon due to want of maps, adverse weather conditions and other reasons and also deliberately under a plan of Grid-control.

The area in upper Rangpur was taken up late under a different planning of the Grids. Two units of workers are working there on mostly random-mauza scheme, entire mauzas being taken for Grids. Their work is expected to be over by the end of this month (August).

Inspection and Checking.—The main task of Chief Inspectors and Inspectors lay in touring constantly round their charge and inspecting work of their subordinates. About 10 per cent of the work was checked by them. In order to intensify check on the work of the primary recorders, four additional Inspectors were appointed for the exclusive duty of checking and inspection. The Supervisor and the Assistant Supervisor between them inspected work in all the districts. The Secretary himself had to make time to inspect work in Jessore and Comilla districts.

8. THE AREA IN MAPS :

Work had to be carried on with the help of Settlement maps. An accurate identification of the plots is a *sine qua non* of the correct filling up of the crop column of Khasras. Settlement of the districts is pretty old by now, ranging from 1893-95 in Chakla Roshnabad (Comilla) to 1931-35 in Rangpur district. The districts of Dacca, Mymensingh, Comilla and Rajshahi were surveyed during the period 1907-1920, while Jessore, Nadia and Bogra had their maps prepared during 1920 and 1924.

Maps change, or rather, the ground configurations change due to various reasons, *viz.* subinfeudation, partition, purchase and numerous other factors. The fluvial action of rivers effaces the *ails* and landmarks on the extensive and rich riparian and char areas.

The field-worker has to be a man of ready wit, with a general idea of the system of survey and the different scales of mapping

and a workable knowledge of the technical methods of "triangulation" and "prologation". The workers were given preliminary training for a few days in the beginning with instruction to refer all mapping difficulties to superior officers.

9. CONCLUSION.

Prof. Mahalanobis kindly kept himself in constant touch with the operation. His advice and instructions were invaluable even on matters of administrative detail. The Secretary always kept a close eye on Field Section which could always count on his sympathetic and helpful guidance.

The Assistant Supervisor with his valuable statistical experience was indispensable for an operation like this. His tact and skilful guidance avoided many a pitfalls.

Of the Chief Inspectors, Messrs. Kanti Banerjee, Saroj Chakravarty and B. K. Dasgupta came here with their previous experience in Jute Registration. Mr. Pranay Chatterjee was the most indefatigable worker. Messrs. Lokesh Guha Roy and Jyoti Prokash Sen had previous statistical training which stood them in good stead in managing their work. The glorious band of Inspector and Investigators, mostly un-employed but enthusiastic youngmen who helped a successful termination of the field-work demand all the praise that is their due.

A summary operation like this, organized and disbanded within a short period of time raises various problems in respect of details of organization and management which have been successfully tackled this year. It is in many respects analogous to settlement operation with the broad difference that while in settlement there is a permanent and hence responsible body of Kanungos who can be called to account for any lapse, there is no such body of workers here. The setting up of a small staff for doing preliminary spade-work during the off-season and for taking up the key positions during actual field work is a desideratum.

10. THE BUDGET :

A complete budget based on the actuals of expenditure cannot be given now for the obvious reason that disbursements have not yet been completed,

The original and the revised estimates are as follows:—

—	Budget Estimates (Jute Census Committee meeting dated 7.3.40).	Revised Budget Estimates (Jute Census Committee meeting dated 25.7.40).
1. Pay of Establishment :		
(a) Field Staff. ...	57,845	43,916
(b) Head Office ...	2,790	2,685
2. Allowances ...	6,230	6,000
3. Contingencies ...	2,000	5,650
4. Leave and pension contribution of the Supervisor ...	Nil.	400
5. Area Extraction work.	3,270	4,000
6. Expenditure incurred in preparatory Field work. ...	6,000	7,000
	78,135	69,651

The Field Office has to disburse amounts of the following heads only, *viz.* :—

1. Pay of Establishment—

(a) Field Staff (except pay of Supervisor which is disbursed by Secretary's office).

(b) Head Office.

2. Allowances (except T. A. of Supervisor which is disbursed by Secretary's office).

& 3. Contingencies.

The following statement gives an account of the actual disbursement by Field Office up to 31st July, 1940. The July

Account has been sent to Secretary's office on the 21st August, 1940.

	Budget (I. C. J. C. meeting dated 7.3.40.	Revised Budget I. C. J. C. meeting dated 25.7.40.	Actual expenditure up to 31.7.40.
1. (a) Pay of Supervisor. } 2,000		2,450	?
Pay of other Field staff ... } 55,845		41,466	29,818 7 6
(b) Head Office ... } 2,790		2,685	1,482 1 0
2. T. A. of Supervisor } 6,230		700	?
Allowances of other Field staff ... } 5,300		5,300	3,287 3 0
3. Contingencies ... } 2,000		5,650	3,435 12 0
	68,865	58,251	38,023 7 7

The actual expenditure of Rs. 29,818-7-6 under head "Pay of other Field Staff" includes Rs. 1,767-9-0 paid to the Jute staff for their part-pay of April due for their service under the Director of Agriculture before their joining Census work. This latter amount will be added to the Census budget and deducted from the contribution to the Government of Bengal on account of the Committee's Jute staff. So, actually the expenditure up to the 31st July for Census work amounted to Rs. 36,255-14-6 disbursed by the Field office.

Crop Estimating Survey.

The Jute Census Committee at its meeting held on the 25th July decided that a crop-cutting experiment on a small scale should be undertaken this year to determine the best size of the cut and to find out the time and cost factor for planning an All-Bengal scheme.

Thirteen thanas in four districts (Mymensingh, Dacca, Rangpur and Comilla) were selected for the purpose. 4 Inspectors and 24 Investigators were appointed for the work and they joined between 27th and 30th July. They were given proper training to enable them to conduct the work accurately and were sent to their respective stations on the 2nd August. The work is expected to be finished by the first week of September.

Collection of Maps for 1941 work.

It was also decided in the meeting of the 25th July that during 1941 the Sample Census Work would be extended to all Jute growing districts of Bengal so that a correct forecast figure for the 1941 crop might be arrived at. Arrangements have been made for the purchase of village, thana, district maps, etc., from the different district offices for the 1941 Census work. 29 clerks have been appointed and sent to different district head-quarters on the 19th August to collect the maps which will number about two lacs. It is expected that all work will be finished by the end of September.

S. K. BANERJI,
Supervisor.

The 21st August, 1940.

APPENDIX II

NOTE BY THE SECRETARY DATED 29TH AUGUST, 1940, ON SUBJECT NO. 47.—*To consider the preliminary statistical report by Prof. P. C. Mahalanobis of the Sampling Census of Jute, 1940.*

Enclosed for the information of the members is a copy of the preliminary statistical report (Enclosure) on the field work done in connection with the Sampling Census of Jute in the current season. As it was very necessary that the report should be in the hands of the members in good time for the meeting to be held in the next week, Secretary considered it advisable to circulate copies of it as soon as it was received in the office with such running comments on it as suggested themselves to him within the very short time at his disposal:

Para. 3 (pp. 1 and 2) of Prof. Mahalanobis's Report contains the summary of his conclusions. In view of the considerable discussion that took place at the meeting of the Jute Census Committee held in April, 1939, members will be interested in the comparative results obtained by the half-sampling method. Prof. Mahalanobis finds that these results agree substantially, such differences as are noticed being statistically negligible. If that is so, this fact would seem to establish the essential reliability of the sample survey undertaken in the current year. Incidentally, it may be noted that the half-sampling method provides a useful internal check on field work which, in the absence of any other independent external check, may, in future, provide a valuable corrective to any large scale errors that may otherwise occur in the estimates obtained from the field work.

Prof. Mahalanobis calculates the margin of error for the whole area of which the acreage census was taken at 3·4 per cent. The details will be found in column 8 of Table 10. As he points out, this is well within the margin of 5 per cent which was considered reasonable at an earlier meeting of the Jute Census Committee and is generally considered to be quite satisfactory for purposes of forecasting. Members may like to compare the results obtained by Prof. Mahalanobis with the acreage figures given by the Director of Agriculture, Bengal, in his preliminary forecast

of the jute crop for the current season. Accordingly, Secretary has had the following table prepared in the office. No comments on these comparative figures can be usefully made at this stage.

Forecast of area under Jute in Bengal, 1940.

District.	Area (Sq. miles)	Proportion of jute (%) (Mean of A & B estimates)	Estimated jute area		Jute Area (acres) Preliminary Govt. forecast.
			Sq. miles	Acres.	
Nadia	2,839	6.22	176.5858	1,13,015	80,000
Jessore	2,915	10.50	306.0750	1,95,888	1,08,900
Rajshahi	2,532	13.21	334.4772	2,14,065	1,27,400
Bogra	1,471	18.25	238.4575	1,71,113	1,42,000
Tipperah	2,536	28.18	714.6448	4,57,373	3,42,500
Rangpur	3,602	30.58	1101.4916	7,04,955	3,68,000
Mymensingh	6,304	25.68	1618.8672	10,36,075	8,00,000
Dacca	2,652	24.45	648.4140	4,14,985	3,93,700
Total :	24 851	21.81	*5169.0131 †5420.0031	*3,308,169 3,463,802†	23,62,500

*Total estimate based on individual district area.

†Total estimate based on total area of all districts.

1 Sq. Mile = 640 acres.

So far as the technique of the random sampling method is concerned, it appears that after the records of the field work have been examined in greater detail and the final statistical report, which Prof. Mahalanobis promises later on, is received, it will be possible to settle definitely the question of the best *size* and the *distribution* of sampling units. For one thing, the question of cost is inextricably bound up with these problems, and, as the cost function is still under investigation, the Professor is naturally

unable to express any definite views on these points. When, however, the problem of size and distribution of grids have been settled towards the end of this year, the determination of the best technique will have been well within sight. But from such tentative results as have been embodied in this preliminary report, members will notice that the grid-cost of field operations this year has been considerably lower than that incurred in 1939. Credit for this reduction in cost is due largely to the better design, organisation and supervision of the Field Staff. Professor Mahalanobis has discussed all relevant factors bearing on this point in paragraphs 14 to 18; it is therefore unnecessary to comment on this aspect of the field work any further.

For the reasons which he mentions in the opening paragraph of his report, Prof. Mahalanobis has been unable to give the design or the details of the scheme of work that will be adopted for the coming year. In paras 26-29, however, he discusses one aspect of the next year's work, *viz.* area-extraction. Secretary agrees that, if the results of next year's work are to be available for the purpose of forecasting (it does not follow that the forecast will be available for publication) it will be necessary to take up the work of area-extraction long before the field records are due to come back to the Statistical Laboratory. This will entail some increase of expenditure under this head, but this seems to be unavoidable.

The budget, Professor Mahalanobis has submitted is a skeleton budget for 1941. As he himself points out, till the costs of the detailed cost-analysis are obtained, the estimates cannot be very firm. Some important administrative decisions regarding the next year's work that have yet to be taken may further affect the estimates. Besides, the proposed provisions under the different heads will have to be carefully checked in the light of the past actuals before they can be accepted. Within the short space of time between now and the next meeting of the Committee, it will not be possible for this office to undertake this examination of the estimates. Secretary, therefore, suggests that the details of the provisional budget may be examined at the meeting of the Joint Census Committee to be held some time after the ensuing Puja holidays. Meanwhile, the main Committee may be informed that the cost of the next year's work will not exceed Rs. 180,000.

Prof. Mahalanobis suggests two new items of experimental work, *vis.* (1) Zoning and model sample experiments, (2) some experiments on optical methods.

(1) *Zoning experiments.*—Prof. Mahalanobis has explained the need for zoning experiments in Paras. 24 and 25. Secretary considers that this is an item of work which is part of the exploratory survey undertaken by the Committee, and will, therefore, be a legitimate charge on the cost of the Committee's Forecast Improvement scheme. The only comments that he has got to make are:—(a) that the details of the provision of Rs. 7,500 will have to be examined at the next meeting of the Jute Census Committee along with the other items in the budget. At that meeting, the Professor will doubtless explain the basis of his calculation under this head; (b) that the "good deal of correspondence" to which Prof. Mahalanobis refers in para 25 of his Report was presumably undertaken by him direct with the Government of Bengal and not with or through this office.

(2) *Experiments on Optical Methods.*—If the standardisation of the random sampling technique at the smallest cost compatible with reasonable efficiency is the object underlying the present scheme of exploratory survey, Secretary is inclined to think that the optical experiments for which the Professor asks for a provision from the Committee will be a proper charge on its cost, even though the Committee may cease to have any interest in the application of the fully developed technique after 1941. There are one or two points of detail in regard to this experiment on which Secretary will like some further elucidation, and members may also wish to have some more light. But it is unnecessary to cumber this note with a discussion of these points. Doubtless, the Professor will be able to explain, in the meeting itself, the points that seem to require further clarification. Here too, as in the case of the zoning experiment, it will be necessary to examine the question of provision of funds at a later meeting of the Jute Census Committee which Secretary has already suggested. In regard to the financing of this experiment, Prof. Mahalanobis has suggested that if the Committee approves of his proposal he would not require a further set of Mouza maps for the 8 districts which were surveyed this year. He says that he will be able to proceed with the work on the basis of the maps already with him. Members of the Jute Census Committee will recall that it was at the

instance of the Professor that it was decided to purchase one set of Mouza maps of these 8 districts in addition to two sets of Mouza maps for the other 11 new districts, at the last meeting of the Jute Census Committee. Prof. Mahalanobis's proposal will thus involve a modification of the decision reached at the last meeting of the Jute Census Committee. As he proposes to do without the maps of the 8 old districts and to save a sum of Rs. 5,000, Secretary has, in anticipation of the decision of the Committee, directed the Field Supervisor to stop further work on the collection of maps in these 8 districts. If the Committee approves of the Professor's proposal for optical experiments, the work of collection of maps for these 8 districts will be finally abandoned. The question of diversion of the savings of about Rs. 5,000 to this experiment may be considered by the Jute Census Committee along with the other items of the budget.

In order that the Professor can proceed with the work, the Committee may accord its approval to the proposals as regards these two experiments, subject to the definite stipulations (1) that the total expenditure of the Committee on the scheme of Forecast Improvement will not exceed Rs. 1,80,000 and (2) that funds for these experiments will be available only after the financial requirements of the scheme under other heads—both in regard to field and statistical work—such as are approved by the Jute Census Committee at a later meeting, have been fully met.

The subject is for the consideration of the Committee.

ENCLOSURE

Preliminary Report on the Sample Census of the area under Jute, 1940.

By P. C. Mahalanobis

SECTION 1. INTRODUCTION AND SUMMARY.

At the time of writing this Preliminary Report all the field records have not reached the Statistical Laboratory. The results given here are therefore based, not on the whole material, but on such portions of the data as could be analysed in time. The comparison of the margin of error is based on the survey of 18,414 square miles out of about 21,000 square miles proposed to be covered this year; the results, therefore, give a substantially correct picture of the position. The cost figures are also based on the same area, and are quite reliable as far as they go. The "cost function", however, has not yet been fully investigated so that it is not possible to give details regarding the design of the survey for 1941.

2. The time at my disposal was very short; and I have been obliged to write the report in the course of two days. I have therefore stated the results without any detailed discussion of the figures given in the tables. I have discussed the margin of error of the Sample Census in Section 2; the cost of operations in Section 3; and the programme of work for 1941 in Section 4. Finally, in Section 5 and the appended Table (A), I have given a provisional budget for 1941 in an abstract form.

Summary of Conclusions

3. A summary of conclusions is given below :

- (1) The material was collected independently in the form of two Half-samples (A) and (B) by different sets of investigators. A comparison of the two different estimates for 159 police stations showed that, on the whole, the agreement was not unsatisfactory.
- (2) The difference between the two estimates was statistically negligible in the case of each of the eight

districts in which the Sample Census was carried out this year.

- (3) For the whole area of 18,412 square miles, the proportion under jute was found to be 22.21 ± 0.15 per cent in Half-sample (A), and 21.52 ± 0.15 per cent in Half-sample (B). The difference of 0.69 ± 0.21 per cent is statistically negligible; and the agreement between the two Half-samples is all that can be desired.
- (4) The margin of error for the whole area is about 2.2 per cent which is entirely satisfactory. The reliability of the Sample Census is thus fully established on the results of the large scale field survey carried out over 18,414 square miles.
- (5) The cost of field operations was appreciably lower in 1940 as compared to the cost in 1939. In fact, on an average, 25 per cent more work per day was done in 1940. This all-round increase in efficiency may probably be ascribed to three different factors: (a) better weather conditions; (b) greater experience and training of the inspecting staff; and (c) unity of control in the technical guidance of the field survey.
- (6) In 1939 it was found that sample-units or grids of 4-acre area were on the whole more efficient than grids of larger size. This result has been generally confirmed in 1940.
- (7) Owing, however, to the appreciable reduction in the cost of field operations, the average "best" size of sample-units may be increased from 4-acre to possibly 6 or 7-acre.
- (8) The cost of operations probably differs appreciably in different regions. This means that the best size of grids will be different in different areas; and it is likely that grids of size from 1-acre to 9-acre will probably be most useful in future.
- (9) In the programme of work for 1941 it is proposed to make a special study of the problem of zoning, that is, of demarcating compact areas in which the proportion of area under jute is more or less uniform.

It is also proposed to explore the possibilities of using an optical method for the preparation of sample-units with a view to reducing the cost of maps and the expenditure for the measurement of the area of individual plots.

- (10) In the provisional budget for 1941 the Sample Census has been designed on the basis of an expenditure of Rs. 1,50,000 exclusive of charges of a non-recurring nature. As more experience is gained it may be possible to carry out an annual sample census with a margin of error not exceeding five per cent at a cost of Rs. 1,25,000.

SECTION 2. THE MARGIN OF ERROR.

4. It will be remembered that arrangements had been made to collect the information in the form of two independent Half-samples (A) and (B). The results for the two half-samples have been tabulated by mauzas, unions (or sub-blocks), and thanas (police stations). Owing to shortness of time I am giving here the relevant material for police stations which is quite adequate for our present purposes.

Results by Police Stations

5. The material is shown in Tables (1) - (8)* in which column (1·1) gives simply a serial number used in the Statistical Laboratory for convenience of reference; column (1·2) gives the serial number of the thana (police station) as shown in the alphabetical list; column (1·3) shows the area covered in the present survey in square miles. The next three columns give the results for Half-sample (A); columns (2·1) and (2·2) show the area in acre and the total number of grids respectively; and column (3) the proportion (per cent) of area under jute together with the corresponding standard error. Similarly, columns (4·1) and (4·2) show the area and number of sample-units, and column (5) the proportion (per cent) of area under jute together with the standard error in the case of Half-sample (B). The difference between the two estimates (A) and (B) together with the corresponding standard error is given in column (6).

*The provisional figures given on the 26th August 1940 were checked and the corrected figures have been given here. The corrections were usually of a minor character, and did not affect the general conclusions.

6. The size (area in acres) and the variances of the sample-units (grids) in the two Half-samples being different, we used the classical or large sample expression for "t", *i.e.*, the difference between the two estimates divided by the corresponding standard error.* The probability of occurrence corresponding to each observed value of "t" was then obtained from the normal probability integral as no tables are available for the present form of "t" in the case of small samples. In practice this means that the probability of occurrence given here will be smaller than the true probability as calculated on the small sample theory; so that the agreement between the two half-samples will be tested on a more stringent basis than warranted by facts.

7. The classical value of "t" has been given in column (7), and the corresponding probability of occurrence in column (8) of Tables (1) - (8). From these columns it will be noticed that although there is a preponderance of comparatively small values of $P(t)$ less than five per cent, extremely small values are very rare, and the distribution of P above the 10 per cent level is fairly regular. Keeping in mind the fact that the proportion of comparatively small values will be necessarily increased by the approximate method used in our calculations we may conclude that the agreement between the two Half-samples is on the whole quite satisfactory for individual Thanas.

Results by Districts

8. The results for the eight districts were built up from the police stations, and are shown in Tables (9) and (10). In these tables column (1·1) gives the name of the district; column (1·2) the total area of the district in sq. miles; column (1·3) the area in sq. miles covered in this report; and column (1·4) the total number of thanas on which the results are based. In Table (9) the next six columns from (2·1) - (2·6) show the total number of grids of different sizes in Half-sample (A); in the same way columns (3·1) - (3·6) give the number of grids of different sizes in the case of Half-sample (B).

*The use of the t-statistic for testing the results of a sample census was explained in considerable detail in my Note dated 23rd October 1938 given in Appendix III, Proceedings of the Third Meeting of the Jute Census Committee, 26th October 1938, pp. 21-30; and also the Report on the Crop Census of 1938 on pp. 11-24 of the Proceedings of the Fourth Meeting dated 6th February 1939.

9. In Table (10) columns (5) and (6) give the observed proportion (per cent) of area under jute with corresponding standard errors for the two Half-samples (A) and (B) respectively; and column (7) shows the difference between the two estimates with the standard error; and column (8) this difference expressed as a percentage of the mean proportion shown in column (9). The classical value of "t" and the corresponding P(t) the probability of occurrence, calculated as explained above, are given in columns (10) and (11). It will be seen that the difference between the two estimates are statistically negligible in most cases; that is, the two independent estimates are on the whole in satisfactory agreement.

Estimates for the Whole Area

10. The result for the whole of the area covered in this report, *i.e.*, 18,412 sq. miles, is given at the bottom of the Table (10). In Half-sample (A) the observed proportion (per cent) of the area under jute was 22.21 ± 0.15 against an estimate of 21.52 ± 0.15 per cent in Half-sample (B). The difference between the two estimates was thus only 0.69 ± 0.21 per cent which is quite small. Accepting the mean of the two estimates (A) and (B) *i.e.*, 21.87 per cent as a reliable figure, we find that the divergence between the two Half-samples was 3.16 per cent for the whole area. The margin of error of the pooled estimate for the whole area of 18,414 square miles is thus of the order 2.23 per cent.

11. It will be remembered that at the sixth meeting of the Jute Census Committee it was decided that a margin of error of five per cent would be considered adequate (Proceedings, 10th October 1939, p.5). Judged by this standard the agreement between the two half-samples is entirely satisfactory. In other words, the reliability of the Sample Census has been fully established by the large scale field survey carried out over 18,000 square miles.

12. The first phase of the work is now over. We have every reason to expect that it will be possible to obtain an estimate of the acreage under jute in Bengal by the sampling method with a margin of error not exceeding five per cent in case the field operations can be carried out in 1941 with at least the same efficiency as that actually attained in practice in 1940.

SECTION 3. COST ANALYSIS.

13. I have already mentioned that it has not been possible as yet to investigate the cost function in detail. The preliminary tabulation of the cost figures for 18,414 sq. miles has however been completed; and the observed values for three different sizes of sample-units, 1-acre, 4-acre and 9-acre, are given in Table (11) with corresponding observed figures for 1939 for convenience of comparison. In this Table (11). column (1) gives the name of the district; and column (2) the density or number of grids per sq. mile. The next three columns give the relevant figures for grids of size 1-acre; column (3·1) shows the cost in hours per sq. mile as actually found in 1939; column (3·2) the cost in hours per sq. mile as observed in 1940; and column (3·3) the number of grids on which this result is based. In the same way, the corresponding figures for grids of size 4-acre and 9-acre are given in columns (4·1)–(4·3) and (5·1)–(5·3) respectively. For convenience of comparison the cost in hours in 1939 has been expressed as a percentage of the cost in hours in 1940; and the results are given in columns (6·1), (6·2) and (6·3) respectively.

Appreciable Improvement in Efficiency

14. A comparison of columns (3·1) and (3·2) in the case of 1-acre grids, columns (4·1) and (4·2) for 4-acre grids, and columns (5·1) and (5·2) for 9-acre grids, will show that in each and every case the cost has been appreciably lower in 1940

15. This is brought out quite clearly in the percentage columns (6·1)–(6·3). In fact, using the weighted average, we find that on the whole the cost in hours was 25 per cent higher in 1939 as compared to the cost in hours in 1940. In other words, twentyfive per cent more work was done per day on an average in 1940.

16. This all-reund increase in efficiency is most encouraging, and may probably be ascribed to three different factors: (a) better weather conditions; (b) greater experience and training of a portion of the field staff; and (c) unity of control in the technical guidance of the field survey. On the whole, rainfall was lower in 1940 which made it easier for the field staff to move from one place to another and to do their enumeration work without

interruptions. Secondly, most of the chief inspectors and a large number of inspectors started work this year with one or two years experience of the sample census which naturally helped in carrying out the field survey with efficiency.

17. Finally, with the exception of the preparatory field work, the whole of the field survey this year was organized and carried out under the direct technical guidance and control of the Statistical Branch. This facilitated quick adjustments and such changes in the technical programme as were found necessary from time to time; prevented overlapping and duplication of work; and eliminated wastage due to lack of co-ordination and contact between the Field and Statistical Branches. (But even this year, in the preparatory stage, the work was organized separately; and a certain amount of additional expenditure had to be incurred on account of lack of co-ordination between the two branches.)

18. It will be remembered that in 1938 when the exploratory survey was first started, the field and the statistical work was carried out under joint control. In 1939 the two Branches were separated. In agreeing to this separation I however stated:—

“My own feeling is that unity of control in field and statistical work is desirable; and actual experience may show that it is necessary for the success of the scheme. However, I have agreed to their separation so far as the present programme is concerned, partly because this is a question of detail, and partly because if the required liaison can be maintained between the two sections, it will leave the scientific staff more free to devote their attention to the statistical work.”

(Proceedings, Third Meeting, 26th October 1938, p.34).

I believe in the light of the experience gained in 1938 and 1939 the need of unity of control may be considered as fully established.

SECTION 4. THE PROGRAMME OF WORK FOR 1941.

19. It will be convenient at this stage to recapitulate the aims of the Exploratory Survey. In my first note on the subject dated

26th June 1938* I had pointed out that "the efficient planning of a random sample survey involved, on the technical statistical side, the following points:

- (i) Dividing the province into uniform zones.
- (ii) Determination of the best size of the sample grids.
- (iii) Fixing the total number of sample-units.
- (iv) Fixing of number of grids to be allotted to each zone.
- (v) Locating the grids strictly at random within each zone."

20. In order to prepare the design for the Sample Census we devised a simple instrument worked by hand for locating the grids at random on mauza maps. This apparatus is working quite smoothly, and to this extent item (v) may be considered to have been satisfactorily settled. But there are certain improvements possible in this connexion which I shall discuss presently.

Size and Number of Grids

21. Apart from this essential step we have so far concentrated our attention on finding out the best size and density of the sample-units. Last year we tentatively reached the conclusion that small units of the order of four acres in area were more efficient than large grids of the order of 25 or 30 acres. This result has been on the whole confirmed this year. But the appreciable reduction in the cost of field operation shows that it will be possible to increase the "best average" size from 4-acre to possibly 6 or 7-acre. This because with lower costs it will be possible to enumerate a larger area than that actually covered in 1939.

22. Secondly, there is some evidence to show that the cost of operations, especially in the journey portion, differs appreciably in different districts or regions. This means that grids of different size are likely to be most efficient in different districts or zones. Apart from the question of intensity of cultivation or density of grids, broadly speaking, the lower the cost the larger will be the "best" size of grids.

*Proceedings of the First Meeting of the Jute Census Committee, 6th July 1938.

23. It will be remembered that the optimum distribution of density (or number of grids per square mile) has to be determined jointly on the basis of the intensity of cultivation, variability, and cost of operations. The primary tabulation of the cost figures has been already completed, and the "Cost Function" is being investigated in detail. As soon as this work is finished we hope to be able to settle the question of the best size and distribution of sample units, that is, items (ii), (iii) and (iv), with sufficient accuracy for an efficient design being prepared for the 1941 survey. On present indications it seems likely that we shall have to use sample-units (grids) of different sizes from 1-acre to 9-acre, and densities of from one-fourth (1 grid in 4 sq. miles) to a little less than two grids per square mile for each Half-sample.

Zones

24. We may next consider item (i), namely, the problem of dividing the province into a suitable number of homogeneous zones. This question has been discussed in previous meetings of the Jute Census Committee in considerable detail, and its importance has been emphasized not only by me but by other members of the Committee. In practice, zoning of course depends on our ability to demarcate compact geographical areas each of which has roughly the same intensity of cultivation, that is, roughly the same proportion of area under jute. Zoning thus depends on detailed information regarding the proportion under jute in different thanas or unions; and in the absence of relevant information we have not been able so far to give any attention to this question.

25. Fortunately this year we are collecting information relating to about 21,000 sq. miles. For the first time we are, therefore, in a position to take up the question of zoning in earnest. I may also mention that, after a good deal of correspondence, arrangements have been made to place at our disposal the results of the complete enumeration of jute plots carried out in 1939 by the Government of Bengal; and I hope to receive this material in the course of a few weeks. This will be useful in the present connexion, especially in regard to the eleven new districts covering 30,000 sq. miles for which we have no material of our own. All this will require a great deal of detailed examination. Allowing on an average Rs. 400 for each of the 19 districts proposed to

be taken up next year, I am providing Rs. 7,500 in the budget for zoning studies and model sampling experiments.

Measurement of Plot-areas

26. It is necessary to obtain the area of each individual plot included within the sample-units before tabulation of the primary material can begin. In 1938 the figures were extracted from *khatian* books in the different districts by the field investigators themselves after they had completed their field work. This caused a great deal of delay; and in 1939, at my suggestion, the work was done independently by a different set of men. In the meantime we found that direct measurement on maps with the help of a photographic scale was quite convenient; and in 1940 the area measurement was done in Calcutta by the statistical staff and this has proved extremely convenient in practice.

27. So far we have been measuring the area of only those plots which are reported to be under jute by the field staff. This is economical, but the work of area measurement cannot begin until the field schedules are received in Calcutta which necessarily means delay in starting the tabulation work. It is not possible to overcome this difficulty by employing a large number of men on area measurement. This because the rate at which field schedules are received at headquarters is irregular; so that in case a large staff is employed many of them will have to sit idle from time to time which will mean unnecessary waste of money. In fact the area measurement constitutes a bottle-neck which not only causes delay but also a great deal of inconvenience to the smooth progress of the statistical analysis.

28. The net effect of the present procedure is to cause an appreciable gap between the closing of the field work and the preparation of the acreage estimate. This delay will be of no importance in case the present method is intended to be used merely for a post-mortem examination of the jute estimate. On the other hand, if the Sample Census is desired to be used as a real forecast it is essential that the actual estimate of the acreage under jute should be ready within a few days of the closing of the field survey. In fact, the only practical course is to fix a definite date, say at the end of July, on which the sample estimate of the acreage under jute will be made ready. The estimate in this case

will naturally be based on field schedules received in Calcutta up to a certain date. Obviously, the shorter the gap between these two dates the more accurate will be the final estimate.

29. I think the only way in which we can reduce this interval to less than one week will be to arrange for the area of all plots included within the sample units being measured beforehand. This will be more expensive than the present method, but will enable a real forecast being made in time to be of practical value. I have made necessary provision for this purpose in the draft budget.

The Question of Maps

30. I have repeatedly discussed the question of maps in various notes and reports*. One set of blank maps will be required for the field survey. Last year we purchased about 53,000 maps covering eight districts; this year we shall have to purchase roughly 70,000 maps to cover the eleven new districts. Out of 53,000 maps used this year we have mounted 35,000 maps on linen at a cost of Rs. 4,700; and these linen mounted maps are likely to last for many years. It is possible to mount on linen the remaining 88,000 maps at an approximate cost of Rs. 11,000. It is however not essential to do this immediately as we have found that unmounted maps can be used for two or in some cases even three seasons. The position in this matter has been fully cleared up. In case it is decided to continue the sample census every year there will be no difficulty in having the remaining 88,000 sheets mounted on linen.

31. We also require at least a second set of maps for use in the Statistical Laboratory for marking the grids as well as for zoning and model sampling experiments. Although in some cases the same map may be used more than once, in other cases fresh maps will be required every year. We have to deal with roughly one lakh and twenty thousand maps altogether; on a conservative basis of 50 per cent replacements and at the rate of one anna and six pies per map the recurring expenditure will come to about

*For example, see Proceedings, Second Meeting, 1st September 1938, p. 91; Sixth Meeting, 10th October 1939, p. 2; Seventh Meeting, 13th December 1939, p. 50; and other correspondence.

Rs. 6,000 per year. Even if the maps are supplied free by the Government of Bengal, or the cost is adjusted by book debit, there will still be an actual physical consumption of a huge number of sheets every year.

32. I have considered the question carefully, and I believe an optical device may enable us to eliminate this recurring consumption of maps. The idea is perfectly simple. If we etch a "square-mesh" on a large sheet of glass, and place this on a village map, we can easily measure the area of each individual plot with the help of the small square of the mesh each of which may represent a convenient unit, say 0·04 or 0·05 acre. We may now take a micro-photograph of a village map together with the superposed square-mesh". If we now project on a screen this micro-photograph, through a magic lantern or some suitable optical instrument, we shall get an enlarged image of the village map together with the "square-mesh" superposed on it. It will be then possible to read off the area of any individual plot by direct eye estimation.

33. This is however not all. We may also prepare photographs of random points and grids on a separate film and project these simultaneously on the screen with the mauza maps. We shall then have on the screen (i) an enlarged image of a village map, (ii) the superposed "square-mesh", and (iii) the image of grids located at random. In this way, we can have the location of grids at random, the listing of plots, and the measurement of the area of individual plots all done at the same time. The great advantage of this method is that the area measurement can be finished in the very first or preparatory stage so that tabulation work can start as soon as the field schedules are received at headquarters. Also the preparatory work can be done quite independently of actual maps, and need not therefore in any way interfere with the zoning or model sampling work. Secondly, this method may enable appreciable savings being made in the expenditure for the measurement of the area of individual plots. Finally, it will eliminate the recurring expense on account of maps.

34. I have already made a few tentative experiments on a small scale. As the total number of exposures ultimately required will be of the order of one lakh and twenty thousand it will be necessary to use some kind of cinema film. I first tried 16 mm.

cinema films, but unfortunately the optical resolution was not fully adequate; so we shall have to use the standard 35 mm. cinema films. The preparation of a sufficiently large sheet of "square-mesh" will have to be carefully studied. We have then to find out by direct experiments the most convenient method of giving exposures, *i.e.*, how the maps and the "square-mesh" should be mounted, what should be the lighting arrangements, what type of camera should be used for this purpose. We have also to devise a suitable apparatus for the stationary projection of the cinema films; the instrument must be cheap as we may have to use 30 or 40 at the same time; it must also be strong so as to stand rough handling. Finally, we have to take auxiliary photographs of grids located at random. Cinema photographs of Brownian motion may give a convenient solution; and I have already started experiments in the Physics Laboratory in this connexion.

35. The preliminary experiments have been sufficiently encouraging to justify the subject being studied seriously. The real problem in our case is to develop a method which can be used not only by technicians but by a large number of computers without any scientific training. The method must therefore be tried out on a sufficiently large scale before it can be adopted in practice. I am suggesting that Rs. 7,500 should be provided in the budget for this purpose. If the Committee approves of this proposal, and I can take photographs of mauza maps, I am prepared to release say Rs. 5,000 which would be otherwise necessary for purchasing fresh maps of the eight old districts for Laboratory purposes. In other words, if my suggestion is approved the net expenditure for the optical experiments would come to about Rs. 2,500. The provisional budget has been framed on this basis.

SECTION 5. PROVISIONAL ESTIMATES FOR 1941.

36. The provisional budget in abstract form is given in Table (A). As the "Cost Function" has not yet been investigated it is not possible to give the detailed distribution of the size and number of sample-units; but broadly speaking the present estimate has been framed on the basis of about 85,000 grids altogether, or a little over twice the number of grids used this year. On this basis I believe it will be possible to obtain an estimate of the acreage under jute for the whole province with a margin or error not exceeding five per cent.

37. The total expenditure proposed to be incurred is Rs. 1,80,000 of which Rs. 30,000 has been provided in the budget for 1940-41. As soon as the cost function is fully studied, a detailed technical programme will be prepared giving the distribution of size and density of grids in different regions. When this is done, adjustments between different heads in the provisional estimates may become necessary to keep the total expenditure within sanctioned limits. But, on the whole, the general framework of the budget given in Table (A) may be accepted as substantially correct, and may be used as a basis for making administrative decisions.

38. It will be noticed that Rs. 7,500 has been provided for zoning and model sampling experiments, Rs. 7,500 for developing an optical method for map work, and Rs. 15,000 for the purchase of maps. These charges are of a non-recurring nature. This means that the Sample Census in 1941 is actually being designed on a scale of expenditure of Rs. 1,50,000. In case the optical device proves successful it may be possible to reduce the expenditure for area measurements; as the investigators gain experience, the output of work is likely to increase; and gradually other savings may become possible. It is not therefore unreasonable to hope that in the course of one or two years it will be possible to carry out a sample census with a margin of error of less than five per cent at an annual cost not exceeding Rs. 1,25,000. In case the present Scheme is combined with work on other crops or with crop-estimating surveys it may not be difficult to carry out the sample survey of the jute area with a recurring expenditure of the order of say one lakh of rupees per year.

P. C. MAHALANOBIS

26th August, 1940.

TABLE (A).

Sample Census of Jute area in Bengal :
Provisional Budget for 1941.

1. <i>Field Branch</i>				Rs.
(1·1) Preliminary	...	...	3,000	
(1·2) Field staff	...	...	67,000	
(1·3) Contingency	...	...	8,000	
(1·4) Supervisor & Office	...	...	7,000	
(1·5) Purchase of Maps	...	...	15,000	
			15,000	
		Total Field Branch	...	Rs. 1,00,000
2. <i>Statistical Branch</i>				Rs.
(2·1) Preparatory	...	...	25,000	
(2·2) Area Measurement (full)	...	...	15,000	
(2·3) Preparation of Forecast	...	...	10,000	
(2·4) Cost and Error Analysis	...	...	7,500	
			7,500	
		Total Statistical Branch		Rs. 57,500
3. <i>Overhead</i>	...	...	...	Rs. 7,500
				Rs. 1,65,000
4. <i>Special Work (Non-recurring)</i>				Rs.
(4·1) Zoning and Model Sample Experiments	...	...	7,500	
(4·2) Optical Methods	...	...	7,500	Rs. 15,000
			7,500	
		Grand Total Rs.	...	Rs. 1,80,000

TABLE 1.

Comparison of Half-Samples by Thanas (Police Stations)

Serial No.	Thana No.	Area included (sq. miles.)	Half-Sample A			Half-Sample B			Differences between two Estimates (A-B) \pm Standard Error.	Classical (approx.)	
			Grid		Proportion (percent) under Jute \pm S. E.	Grid		Proportion (percent) under Jute \pm S. E.		Diff. \pm S. E.	Probability P (t)
			Acre	Number.		Acre	Number.				
(1·1)	(1·2)	(1·3)	(2·1)	(2·2)	(3)	(4·1)	(4·2)	(5)	(6)	(7)	(8)
District—MYMENSING.											
1	13	164	4·00	195	9·23 \pm 1·20	4·00	217	7·68 \pm 0·94	1·55 \pm 1·52	1·02	0·30
2	36	206	4·00	297	5·84 \pm 0·65	9·00	296	9·50 \pm 0·93	-3·66 \pm 1·13	-3·24	0·00*
3	40	67	9·00	97	26·03 \pm 2·09	4·00	93	29·26 \pm 2·40	-3·23 \pm 3·19	-1·01	0·31
4	13	231	4·00	337	29·49 \pm 1·40	4·00	337	26·49 \pm 1·23	3·00 \pm 1·86	1·61	0·11
5	44	134	4·00	185	20·88 \pm 1·56	4·00	181	16·19 \pm 1·18	4·69 \pm 1·95	2·41	0·02
6	46	135	4·00	157	24·03 \pm 1·66	2·25	159	29·06 \pm 2·12	-5·03 \pm 2·70	-1·86	0·06
7	47	119	9·00	146	37·66 \pm 2·07	4·00	120	26·64 \pm 2·30	11·02 \pm 3·10	3·55	\angle 0·001
8	2	74	4·00	110	35·18 \pm 3·24	4·00	108	26·17 \pm 2·96	9·01 \pm 4·36	2·05	0·04
9	4	73	4·00	107	26·78 \pm 2·81	4·00	106	26·91 \pm 2·52	-0·13 \pm 3·77	-0·03	0·98
10	9	181	4·00	263	9·41 \pm 0·89	4·00	261	9·27 \pm 1·00	0·14 \pm 1·34	0·10	0·92
11	17	191	4·00	271	10·87 \pm 1·38	4·00	280	13·44 \pm 1·59	-2·57 \pm 2·10	-1·22	0·22
12	20	161	4·00	214	6·88 \pm 0·98	4·00	210	10·64 \pm 1·35	-3·76 \pm 1·67	-2·25	0·02
13	24	112	4·00	152	5·54 \pm 1·19	4·00	152	0·91 \pm 0·74	4·63 \pm 1·40	3·31	\angle 0·001
14	31	95	4·00	133	24·29 \pm 2·73	4·00	145	16·38 \pm 2·24	7·91 \pm 3·53	2·24	0·03

15	25	90	4.00	132	30.20 ± 3.07	4.00	130	15.73 ± 2.54	14.47 ± 3.98	3.64	∠ 0.001
16	38	106	4.00	155	22.71 ± 2.00	4.00	155	24.97 ± 1.80	-2.26 ± 2.69	-0.84	0.40
17	49	55	4.00	80	34.70 ± 3.43	4.00	80	31.80 ± 3.49	2.90 ± 4.89	0.59	0.55
18	1	112	4.00	166	14.27 ± 1.92	4.00	159	18.90 ± 2.26	-4.63 ± 2.97	-1.56	0.12
19	3	71	1.00	101	38.76 ± 3.76	4.00	101	32.61 ± 2.93	6.15 ± 4.76	1.29	0.20
20	6	41	4.00	57	45.02 ± 5.08	4.00	59	47.41 ± 4.69	-2.38 ± 6.92	-0.35	0.72
21	14	46	1.00	67	41.09 ± 3.86	4.00	65	38.26 ± 3.18	2.83 ± 5.00	0.57	0.57
22	16	202	4.00	284	49.19 ± 1.83	9.00	283	41.23 ± 1.45	7.96 ± 2.33	3.42	∠ 0.001
23	21	76	1.00	107	59.43 ± 4.00	4.00	105	54.14 ± 3.47	5.29 ± 5.29	1.00	0.32
24	22	84	4.00	112	35.07 ± 2.70	6.25	116	39.97 ± 2.57	-4.90 ± 3.73	-1.31	0.19
25	23	129	6.25	188	42.95 ± 2.07	4.00	185	38.08 ± 1.89	4.87 ± 2.81	1.73	0.08
26	26	67	4.00	85	34.56 ± 2.47	4.00	88	34.32 ± 2.18	0.24 ± 3.30	0.07	0.92
27	27	30	4.00	43	45.63 ± 4.31	4.00	43	42.30 ± 5.21	3.33 ± 6.76	0.49	0.62
28	37	126	4.00	174	48.51 ± 2.32	4.00	175	45.73 ± 2.08	2.78 ± 3.12	0.89	0.37
29	39	110	4.00	161	20.81 ± 2.28	4.00	161	20.88 ± 2.41	-0.07 ± 3.32	-0.02	0.98
30	41	68	4.00	90	36.49 ± 2.63	2.25	88	37.58 ± 2.23	-1.09 ± 3.45	-0.32	0.75
31	8	161	4.00	94	26.37 ± 2.52	4.00	163	20.44 ± 1.61	5.93 ± 2.99	1.98	0.04
32	15	132	1.00	159	20.17 ± 2.16	4.00	146	24.32 ± 1.88	-4.15 ± 2.87	-1.43	0.15
33	18	218	4.00	302	28.20 ± 1.40	4.00	299	30.95 ± 1.52	-2.75 ± 2.06	-1.33	0.18
34	28	79	4.00	76	33.16 ± 2.73	2.25	81	27.09 ± 2.80	6.07 ± 3.91	1.55	0.12
35	29	186	4.00	261	19.77 ± 1.31	1.00	263	18.56 ± 1.54	1.21 ± 2.02	0.60	0.55
36	30	91	4.00	131	28.23 ± 2.08	4.00	131	34.63 ± 2.47	-6.41 ± 3.22	-1.99	0.04
37	33	119	4.00	176	20.11 ± 1.55	4.00	168	28.59 ± 1.62	-8.48 ± 2.25	-3.77	∠ 0.001
38	34	143	4.00	199	28.25 ± 1.68	6.25	199	37.27 ± 1.95	-9.02 ± 2.57	-3.51	∠ 0.001
39	11	170	6.25	217	17.15 ± 1.63	4.00	197	27.49 ± 1.70	-10.34 ± 2.36	-4.38	∠ 0.001
40	12	235	4.00	197	34.94 ± 1.70	4.00	180	29.93 ± 1.99	5.01 ± 2.62	1.91	0.06
41	19	179	4.00	147	33.12 ± 2.11	4.00	222	28.88 ± 1.76	4.24 ± 2.75	1.54	0.12
42	42	192	4.00	276	20.15 ± 1.23	4.00	279	18.66 ± 1.01	1.49 ± 1.59	0.94	0.34
43	45	69	4.00	91	25.56 ± 2.88	4.00	87	36.77 ± 2.77	-11.21 ± 3.99	-2.81	0.00*

TABLE 1.—Contd.

Comparison of Half-Samples by Thanas (Police Stations)

Serial No.	Thana No.	Area included (sq. miles)	Half-Sample A			Half-Sample B			Differences between two Estimates (A-B) \pm Standard Error	Classical (approx.)		
			Grid		Proportion (percent) under Jute \pm S. E.	Grid		Proportion (percent) under Jute \pm S. E.		"t"	Diff. S. E.	Probability P (t)
			Acre	Number		Acre	Number					
(1.1)	(1.2)	(1.3)	(2.1)	(2.2)	(3)	(4.1)	(4.2)	(5)	(6)	(7)	(8)	
District.—MYMENSINGH—(Contd.)												
44	50	91	4.00	107	40.09 \pm 2.73	4.00	103	40.67 \pm 2.59	-0.58 \pm 3.76	-0.15	0.88	
45	5	166	4.00	84	20.76 \pm 2.75	6.25	221	21.84 \pm 1.34	-1.08 \pm 3.06	-0.35	0.72	
46	7	167	4.00	122	20.58 \pm 1.69	4.00	217	10.96 \pm 0.96	9.62 \pm 1.95	4.93	< 0.001	
47	10	150	4.00	221	31.95 \pm 1.69	2.25	215	33.80 \pm 1.92	-1.85 \pm 2.56	-0.72	0.47	
48	32	144	4.00	170	29.09 \pm 1.73	4.00	177	32.30 \pm 1.90	-3.21 \pm 2.56	-1.25	0.12	
49	35	108	9.00	122	24.70 \pm 1.61	4.00	122	25.61 \pm 1.95	-0.91 \pm 2.53	0.36	0.72	
50	48	150	2.25	167	26.91 \pm 2.00	4.00	167	20.00 \pm 1.58	6.91 \pm 2.55	2.71	0.00*	

TABLE 2.

Comparison of Half-Samples by Thanas (Police Stations)

Serial No.	Thana No	Area included (sq. miles)	Half-Sample A			Half-Sample B			Differences between two Estimates (A-B) \pm Standard Error	Classical (approx.)	
			Grid		Proportion (percent) under Jute \pm S. E.	Grid		Proportion (percent) under Jute \pm S. E.		Diff. \pm S. E.	Probability P(t)
			Acre	Number		Acre	Number				
(1.1)	(1.2)	(1.3)	(2.1)	(2.2)	(3)	(4.1)	(4.2)	(5)	(6)	(7)	(8)
District—DACCA.											
1	3	72	4.00	88	18.60 \pm 1.74	4.00	86	20.15 \pm 2.03	-1.55 \pm 2.68	-0.58	0.56
2	4	115	4.00	123	26.60 \pm 1.73	4.00	126	34.48 \pm 1.60	-7.88 \pm 2.36	-3.34	< 0.001
3	7	56	4.00	57	20.32 \pm 2.08	4.00	72	20.11 \pm 2.16	0.21 \pm 3.00	0.07	0.94
4	8	91	4.00	132	19.95 \pm 1.61	4.00	137	21.34 \pm 1.66	-1.39 \pm 2.31	-0.60	0.55
5	10	121	4.00	88	21.59 \pm 2.27	4.00	116	20.03 \pm 2.01	1.56 \pm 3.03	0.52	0.60
6	15	44	4.00	85	15.74 \pm 1.55	4.00	69	20.19 \pm 2.07	-4.45 \pm 2.58	-1.72	0.08
7	23	132	4.00	184	19.79 \pm 1.87	9.00	185	18.47 \pm 1.60	1.32 \pm 2.47	0.53	0.60
8	24	60	4.00	58	22.43 \pm 2.27	4.00	54	21.85 \pm 2.63	0.58 \pm 3.48	0.17	0.86
9	28	64	4.00	81	16.25 \pm 1.59	9.00	80	16.10 \pm 1.61	0.15 \pm 2.26	0.07	0.94
10	5	25	4.00	50	19.96 \pm 3.26	4.00	50	21.30 \pm 2.32	-1.34 \pm 4.00	-0.34	0.73
11	6	31	4.00	25	20.36 \pm 4.58	1.00	47	27.51 \pm 4.66	-7.15 \pm 6.54	-1.09	0.27
12	9	137	4.00	106	21.26 \pm 2.01	4.00	95	18.75 \pm 1.82	2.51 \pm 2.71	0.93	0.37
13	13	70	6.25	67	30.58 \pm 2.59	4.00	73	23.79 \pm 2.43	6.79 \pm 3.56	1.91	0.06

TABLE 2—(Contd.)

Comparison of Half-Samples by Thanas (Police Stations)

Serial No.	Thana No.	Area included (sq. miles)	Half-Sample A			Half-Sample B			Differences between two Estimates (A-B) \pm Standard Error	Classical (approx.)	
			Grid		Proportion (percent) under Jute \pm S. E.	Grid		Proportion (percent) under Jute \pm S. E.		Diff. \pm S. E.	Probability P (t)
			Acres	Number		Acres	Number				
(1.1)	(1.2)	(1.3)	(2.1)	(2.2)	(3)	(4.1)	(4.2)	(5)	(6)	(7)	(8)
District—Dacca—(Contd.)											
14	14	50	4.00	67	26.96 \pm 2.26	4.00	64	24.11 \pm 2.97	2.85 \pm 3.73	0.76	0.44
15	17	58	4.00	127	52.28 \times 2.80	4.00	142	46.11 \pm 2.52	6.17 \pm 3.77	1.64	0.10
16	20	98	4.00	116	10.03 \pm 1.26	4.00	113	11.90 \pm 1.72	-1.87 \pm 2.14	-0.87	0.38
17	25	64	4.00	82	30.36 \pm 3.17	4.00	88	25.18 \pm 2.74	5.18 \pm 4.19	1.24	0.21
18	27	79	4.00	103	26.76 \pm 2.04	1.00	99	23.18 \pm 2.53	3.58 \pm 3.25	1.10	0.27
19	29	72	4.00	103	22.01 \pm 2.11	4.00	96	22.18 \pm 1.83	-0.17 \pm 2.79	-0.06	0.95
20	31	46	4.00	63	32.24 \pm 2.89	4.00	60	35.60 \pm 3.09	-3.36 \pm 4.23	-0.79	0.43
21	32	111	4.00	163	10.31 \pm 1.26	4.00	160	14.89 \pm 1.45	-4.58 \pm 1.92	-2.38	0.02
22	1	65	2.25	97	38.80 \pm 2.64	4.00	97	34.41 \pm 2.84	4.39 \pm 3.89	1.13	0.26
23	2	64	6.25	90	35.20 \pm 2.79	4.00	88	36.09 \pm 2.86	-0.89 \pm 3.99	-0.22	0.83
24	11	105	4.00	159	29.55 \pm 2.22	2.25	157	26.84 \pm 2.01	2.71 \pm 3.00	0.90	0.37
25	12	136	2.25	142	17.74 \pm 1.79	4.00	116	19.60 \pm 1.71	-1.86 \pm 2.48	-0.75	0.45
26	16	96	1.00	136	37.23 \pm 2.57	4.00	186	28.10 \pm 1.96	9.13 \pm 3.32	2.93	0.00*

TABLE 2—Contd.

Comparison of Half-Samples by Thanas (Police Stations).

Serial No.	Thana No.	Area included (sq. miles)	Half-Sample A			Half-Sample B			Differences between two Estimates (A-B) \pm Standard Error	Classical (approx)	
			Grid		Proportion percent under Jute \pm S. E.	Grid		Proportion (percent) under Jute \pm S. E.		Diff. \pm S. E.	Probability P (t)
			Acre	Number		Acre	Number				
(1.1)	(1.2)	(1.3)	(2.1)	(2.2)	(3)	(4.1)	(4.2)	(5)	(6)	(7)	(8)
District—DACCA—(Contd.)											
27	18	19	4.00	26	43.54 \pm 6.59	4.00	19	58.16 \pm 7.26	-14.62 \pm 9.81	-1.49	0.14
28	19	79	6.25	100	35.94 \pm 2.84	4.00	100	37.06 \pm 2.52	-1.12 \pm 3.80	-0.29	0.77
29	21	134	4.00	198	42.33 \pm 2.15	4.00	199	32.79 \pm 2.04	9.54 \pm 2.96	3.22	0.00*
30	22	99	4.00	147	31.05 \pm 2.53	4.00	136	28.41 \pm 2.32	2.64 \pm 3.44	0.77	0.44
31	26	32	9.00	110	24.58 \pm 1.89	4.00	110	23.10 \pm 2.37	1.48 \pm 3.03	0.49	0.62
32	30	177	4.00	89	14.72 \pm 1.68	4.00	38	10.63 \pm 1.93	4.09 \pm 2.56	1.60	0.11

TABLE 3.

Comparison of Half-Samples by Thanas (Police Stations)

Serial No.	Thana No.	Area included (sq. miles)	Half-Sample A			Half-Sample B			Differences between two Estimates (A-B) \pm Standard Error	Classical (approx.)	
			Grid		Proportion (percent) under Jute \pm S. E.	Grid		Proportion (percent) under Jute \pm S. E.		"t" Diff. S. E.	Probability P(t)
			Acre	Number		Acre	Number				
(1.1)	(1.2)	(1.3)	(2.1)	(2.2)	(3)	(4.1)	(4.2)	(5)	(6)	(7)	(8)
District—RANGPUR.											
1	1	121	4.00	133	21.37 \pm 2.08	4.00	123	20.40 \pm 1.74	0.97 \pm 2.71	0.36	0.72
2	2	178	4.00	233	29.12 \pm 1.58	4.00	232	23.87 \pm 1.47	5.25 \pm 2.16	2.43	0.02
3	3	124	2.25	159	38.31 \pm 1.87	4.00	158	33.63 \pm 2.00	4.68 \pm 2.73	1.71	0.09
4	4	74	4.00	97	41.01 \pm 2.00	4.00	97	32.02 \pm 2.08	8.99 \pm 2.88	3.12	0.00*
5	5	100	4.00	131	32.69 \pm 1.66	4.00	131	30.69 \pm 1.50	2.00 \pm 2.24	0.89	0.37
6	6	159	4.00	209	18.18 \pm 1.50	2.25	209	18.43 \pm 1.46	-0.25 \pm 2.09	-0.12	0.90
7	7	90	4.00	118	40.97 \pm 1.97	4.00	118	38.26 \pm 1.94	2.71 \pm 2.76	0.98	0.33
8	8	88	4.00	100	39.48 \pm 2.22	9.00	94	33.60 \pm 1.69	5.88 \pm 2.79	2.11	0.04
9	9	161	4.00	200	36.54 \pm 1.61	4.00	204	40.78 \pm 1.35	-4.24 \pm 2.10	-2.02	0.04

TABLE 4.

Comparison of Half-Samples by Thanas (Police Stations)

Serial No.	Thana No.	Area included (sq. miles)	Half-Sample A			Half-Sample B			Differences between two Estimates (A-B) \pm Standard Error	Classical (approx.)	
			Grid		Proportion (percent) under Jute \pm S. E.	Grid		Proportion (percent) under Jute \pm S. E.		Diff. \div S. E.	Probability P (t)
			Acre	Number		Acre	Number				
(1.1)	(1.2)	(1.3)	(2.1)	(2.2)	(3)	(4.1)	(4.2)	5	(6)	(7)	(8)
District—Tipperah.											
1	1	73	4.00	91	42.03 \pm 2.87	9.00	91	47.91 \pm 2.32	-5.88 \pm 3.69	-1.59	0.11
2	2	185	4.00	236	35.51 \pm 2.19	6.25	221	30.05 \pm 2.11	5.46 \pm 3.05	1.79	0.07
3	3	113	4.00	148	37.09 \pm 2.38	4.00	130	25.28 \pm 2.18	11.81 \pm 3.23	3.66	< 0.001
4	8	141	2.25	184	38.84 \pm 1.84	4.00	183	37.39 \pm 1.58	1.45 \pm 2.42	0.60	0.55
5	9	92	4.00	119	36.57 \pm 2.49	4.00	105	29.83 \pm 2.06	6.74 \pm 3.24	2.08	0.04
6	12	63	4.00	84	33.25 \pm 2.43	4.00	83	35.41 \pm 2.68	-2.16 \pm 3.62	-0.60	0.55
7	14	116	6.25	110	31.13 \pm 2.74	4.00	97	28.25 \pm 2.57	2.88 \pm 3.75	0.77	0.44
8	17	131	4.00	171	30.12 \pm 2.00	4.00	150	30.97 \pm 2.22	-0.85 \pm 2.99	-0.28	0.78
9	18	143	4.00	170	38.84 \pm 2.32	4.00	169	35.75 \pm 2.59	3.09 \pm 3.47	0.89	0.36
10	19	118	4.00	137	19.48 \pm 2.32	4.00	123	21.49 \pm 2.58	-2.01 \pm 3.47	-0.58	0.56

TABLE 4—(Contd.)

Comparison of Half-Samples by Thanas (Police Stations)

Serial No..	Thana No.	Area included (sq. miles)	Half-Sample A.			Half-Sample B			Differences between two Estimates (A-B) \pm Standard Error	Classical (approx.)	
			Grid		Proportion (percent) under Jute \pm S. E.	Grid		Proportion (percent) under Jute \pm S. E.		Diff. \pm S. E.	Probability P (t)
			Acre	Number		Acre	Number				
(1.1)	(1.2)	(1.3)	(2.1)	(2.2)	(3)	(4.1)	(4.2)	(5)	(6)	(7)	(8)
District—TIPPERAH (Contd.).											
11	20	88	4.00	114	39.21 \pm 3.29	4.00	100	24.28 \pm 3.15	14.93 \pm 4.55	3.24	0.00
12	4	153	1.00	185	6.12 \pm 1.08	4.00	178	5.29 \pm 0.81	0.83 \pm 1.35	0.61	0.56
13	5	173	4.00	224	27.53 \pm 1.29	4.00	222	13.62 \pm 1.15	13.91 \pm 1.73	8.04	\angle 0.001
14	6	166	4.00	188	43.10 \pm 2.05	4.00	187	38.55 \pm 1.89	4.55 \pm 2.78	1.64	0.10
15	7	107	9.00	135	6.81 \pm 1.01	4.00	133	3.93 \pm 0.72	2.88 \pm 1.23	2.34	0.02
16	10	94	4.00	121	38.79 \pm 1.84	1.00	109	42.76 \pm 2.56	-3.97 \pm 3.16	-1.26	0.21
17	11	132	4.00	170	28.78 \pm 1.56	4.00	169	19.80 \pm 1.46	8.98 \pm 2.14	4.20	\angle 0.001
18	13	93	4.00	121	25.37 \pm 1.88	4.00	120	24.78 \pm 1.75	0.59 \pm 2.56	0.23	0.44
19	15	207	4.00	269	13.56 \pm 0.94	2.25	267	11.06 \pm 1.05	2.50 \pm 1.41	1.77	0.08
20	16	148	4.00	194	45.90 \pm 2.21	1.00	185	41.74 \pm 1.98	4.16 \pm 2.96	1.41	0.16

TABLE 5.

Comparison of Half-Sample by Thanas (Police Stations)

Serial No.	Thana No.	Area included (sq. miles)	Half-Sample A			Half-Sample B			Differences between two Estimates (A-B) \pm Standard Error	Classical (approx)	
			Grid		Proportion (percent) under Jute \pm S. E.	Grid		Proportion (percent) under Jute \pm S. E.		"t" Diff. \div S. E.	Probability $\Gamma(t)$
			Acre	Number		Acre	Number				
(1-1)	(1-2)	(1-3)	(2-1)	(2-2)	(3)	(4-1)	(4-2)	(5)	(6)	(7)	(8)
District—RAJSHAHI.											
1	1	101	4-00	86	12-22 \pm 2-12	4-00	87	12-31 \pm 2-20	-0-09 \pm 3-05	-0-03	0-98
2	2	81	4-00	67	26-27 \pm 2-69	6-25	65	25-20 \pm 2-55	1-07 \pm 3-71	0-29	0-77
3	3	54	9-00	44	11-18 \pm 1-75	4-00	42	14-71 \pm 2-19	-3-53 \pm 2-80	-1-26	.21
4	4	151	2-25	126	9-96 \pm 1-49	4-00	126	14-18 \pm 1-46	-4-22 \pm 2-09	-2-02	.04
5	5	127	1-00	105	11-70 \pm 2-24	4-00	104	5-94 \pm 1-13	5-76 \pm 2-51	2-29	.02
6	6	77	4-00	61	13-21 \pm 2-30	4-00	61	16-28 \pm 2-39	-3-07 \pm 3-32	-0-92	.36
7	7	88	4-00	72	5-89 \pm 1-07	4-00	65	4-09 \pm 1-04	1-80 \pm 1-49	1-21	.23
8	8	155	4-00	128	8-39 \pm 0-96	4-00	130	14-85 \pm 1-63	-6-46 \pm 1-89	-3-42	< 0-001
9	9	103	4-00	93	35-17 \pm 2-99	4-00	93	40-80 \pm 3-03	-5-63 \pm 4-26	-1-32	.19
10	10	95	4-00	82	8-61 \pm 1-99	6-25	82	14-15 \pm 2-65	-5-54 \pm 3-32	-1-67	.09
11	11	203	4-00	166	2-10 \pm 0-48	4-00	165	3-86 \pm 0-62	-1-76 \pm 0-78	-2-26	.02

TABLE 6.

Comparison of Half-Samples by Thanas (Police Stations).

Serial No.	Thana No.	Area included (sq. miles.)	Half-Sample A			Half-Sample B			Differences between two Estimates (A-B) \pm Standard Error	Classical (approx.).	
			Grid		Proportion (percent) under Jute \pm S. E.	Grid		Proportion (percent) under Jute \pm S. E.		Diff. \pm S. E.	Probability P (t)
			Acre	Number.		Acre	Number				
(1.1)	(1.2)	(1.3)	(2.1)	(2.2)	(3)	(4.1)	(4.2)	(5)	(6)	(7)	(8)
District—BOGRA.											
1	1	120	4.00	146	10.29 \pm 1.42	4.00	142	15.32 \pm 1.73	-5.03 \pm 2.24	-2.25	.02
2	2	148	4.00	187	19.06 \pm 1.73	4.00	188	15.72 \pm 1.73	3.34 \pm 2.43	1.37	.17
3	3	95	4.00	117	30.01 \pm 2.45	4.00	117	35.50 \pm 2.65	-5.49 \pm 3.56	-1.54	.12
4	4	63	4.00	77	3.85 \pm 0.72	4.00	77	7.61 \pm 1.42	-3.76 \pm 1.47	-2.56	.02
5	5	94	4.00	115	39.27 \pm 2.65	4.00	115	34.43 \pm 2.24	4.84 \pm 3.49	1.39	.16
6	6	92	4.00	111	31.29 \pm 2.65	4.00	111	32.69 \pm 2.65	-1.40 \pm 3.74	-0.37	.71
7	7	93	4.00	114	22.53 \pm 0.65	4.00	114	4.50 \pm 0.96	-1.97 \pm 1.16	-1.70	.09
8	8	119	1.00	146	5.36 \pm 1.42	4.00	146	5.06 \pm 0.83	0.30 \pm 1.57	0.19	.85
9	9	103	4.00	122	0.39 \pm 0.14	4.00	122	0.83 \pm 0.22	-0.44 \pm 0.26	-1.69	.09
10	10	108	4.00	133	18.26 \pm 1.73	4.00	133	15.05 \pm 1.73	3.21 \pm 2.61	1.23	.21
11	11	200	4.00	244	24.11 \pm 2.00	9.00	245	26.87 \pm 1.73	-2.76 \pm 2.51	-1.10	.27
12	12	114	6.25	140	11.52 \pm 1.42	4.00	140	13.17 \pm 1.73	-1.65 \pm 2.20	-0.75	.45
13	13	122	4.00	149	20.27 \pm 1.73	2.25	149	18.36 \pm 1.73	1.91 \pm 2.45	0.78	.43

TABLE 7.
Comparison of Half-Samples by Thanas (Police Stations)

Serial No.	Thana No.	Area included (sq. miles.)	Half-Sample A			Half-Sample B			Differences between two Estimates (A-B) \pm Standard Error	Classical (approx.)	
			Grid		Proportion (percent) under Jute \pm S. E.	Grid		Proportion (percent) under Jute \pm S. E.		Diff. \pm S. E.	Probability P(t)
			Acre	Number.		Acre	Number				
(1.1)	(1.2)	(1.3)	(2.1)	(2.2)	(3)	(4.1)	(4.2)	(5)	(6)	(7)	(8)
District—JESSORE.											
1	1	226	4.00	166	6.85 \pm 1.00	9.00	170	9.03 \pm 1.00	-2.18 \pm 1.30	-1.68	0.09
2	2	95	4.00	61	19.77 \pm 3.17	4.00	60	12.73 \pm 2.24	7.04 \pm 3.83	1.84	0.07
3	3	88	4.00	67	15.18 \pm 2.83	4.00	67	5.31 \pm 1.42	9.87 \pm 2.96	3.34	< 0.001
4	4	180	4.00	134	6.51 \pm 1.00	1.00	134	8.76 \pm 1.74	2.25 \pm 2.11	-1.07	0.28
5	5	158	4.00	118	12.38 \pm 1.42	4.00	119	11.70 \pm 1.42	0.68 \pm 1.85	0.37	0.71
6	6	147	4.00	108	3.90 \pm 0.72	9.00	94	4.24 \pm 0.64	-0.34 \pm 0.96	-0.35	0.72
7	7	100	4.00	74	16.84 \pm 2.32	4.00	74	19.35 \pm 2.18	-2.51 \pm 3.19	-0.79	0.43
8	8	65	2.25	49	3.78 \pm 1.00	4.00	49	3.51 \pm 1.00	0.27 \pm 1.37	0.20	0.84
9	9	199	4.00	151	5.83 \pm 1.00	4.00	150	6.32 \pm 0.76	-0.49 \pm 1.16	-0.42	0.67
10	10	172	4.00	130	15.09 \pm 1.00	2.25	125	12.42 \pm 1.00	2.67 \pm 1.76	1.52	0.11
11	11	144	1.00	108	13.93 \pm 2.17	4.00	109	19.36 \pm 1.73	-5.43 \pm 2.77	-1.96	0.05
12	12	180	4.00	97	12.93 \pm 1.51	4.00	97	14.29 \pm 1.94	-1.36 \pm 2.46	-0.55	0.56

TABLE 8.

Comparison of Half-Samples by Thanas (Police Stations)

Serial No.	Thana No.	Area included (sq. miles)	Half-Sample A			Half-Sample B			Differences between two Estimates (A-B) \pm Standard Error.	Classical (approx.).	
			Grid		Proportion (percent) under Jute \pm S. E.	Grid		Proportion (percent) under Jute \pm S. E.		"t" Diff. S. E.	Probability P (t)
			Acre	Number		Acre	Number				
(1.1)	(1.2)	(1.3)	(2.1)	(2.2)	(3)	(4.1)	(4.2)	(5)	(6)	(7)	(8)
District—NADIA.											
1	1	123	4.00	65	4.77 \pm 1.73	4.00	67	1.97 \pm 1.41	2.80 \pm 2.24	1.25	0.21
2	2	130	4.00	69	7.72 \pm 1.41	4.00	71	13.03 \pm 2.24	-5.31 \pm 2.76	-1.92	0.06
3	3	103	4.00	52	2.13 \pm 1.00	4.00	52	9.13 \pm 2.24	-7.00 \pm 2.38	-2.94	0.00*
4	4	65	4.00	34	0.00 \pm 0.00	4.00	34	6.44 \pm 2.45	-6.44 \pm 2.43	-2.65	0.00*
5	5	112	4.00	60	10.30 \pm 1.73	4.00	60	6.45 \pm 2.00	3.85 \pm 2.57	1.50	0.13
6	6	138	2.25	73	2.29 \pm 1.00	4.00	73	6.53 \pm 1.41	-4.24 \pm 1.52	-2.79	0.00*
7	7	145	4.00	78	7.06 \pm 1.73	4.00	78	5.88 \pm 1.41	1.18 \pm 2.20	0.54	0.59.
8	8	40	4.00	22	4.00 \pm 1.41	4.00	22	3.14 \pm 1.41	0.86 \pm 1.96	0.44	0.66
9	9	140	4.00	73	5.48 \pm 1.41	4.00	74	4.64 \pm 1.00	0.84 \pm 1.82	0.46	0.65
10	10	170	6.25	90	1.59 \pm 0.00	4.00	89	5.52 \pm 1.41	-3.93 \pm 1.57	-2.50	0.62
11	11	74	6.25	38	5.29 \pm 2.45	4.00	38	8.05 \pm 2.83	-2.76 \pm 3.72	-0.74	0.46
12	12	175	4.00	91	8.07 \pm 1.41	4.00	92	5.62 \pm 1.00	2.45 \pm 1.72	1.42	0.16

TABLE 9.
Results for the two Half-Samples by Districts.

Name of District.	Total Area in sq. miles.	Included in Report.		Half-Sample A Number of Grids.						Half-Sample B Number of Grids.					
		Area in sq. miles	No. of Thana	1 ac.	2·25 acre	4 ac.	6·25 acre	9 ac.	Total.	1 ac.	2·25 acre	4 ac.	6·25 acre	9 ac.	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Nadia ...	2839	1415	12	...	73	544	128	...	745	...	...	750	...	...	750
Jessore ...	2915	1704	12	108	49	1106	...	...	1263	134	125	725	...	264	1248
Rajshahi ...	2532	1235	11	105	126	755	...	44	1030	...	...	873	147	...	1020
Bogra ...	1471	1471	13	146	...	1515	140	...	1801	...	149	1405	...	245	1799
Tipperah ...	2536	2536	20	185	184	2557	110	135	3171	169	267	2334	221	91	3022
Rangpur ...	3602	1095	9	...	159	1221	...	...	1380	...	209	1063	...	94	1366
Mymensingh ...	6306	6306	50	434	167	6614	405	365	7985	263	543	6374	536	579	8295
Dacca ...	2652	2652	32	136	239	2520	257	110	3262	146	157	2640	...	265	3208
TOTAL ...	24853	18414	159	1114	997	16832	1040	654	20637	652	1450	16164	904	1538	20708

TABLE 10.

Comparison of Results for the Two Half-Samples by Districts.

Name of District	Total Area in sq. miles	Included in Report		Proportion under Jute (Percent) with Standard Error		Differences between two Estimates (A - B)		Mean Proportion (A - B)/2	Classical (approximate)	
		Area in sq. miles	No. of Thanas	Half-Sample A	Half-Sample B	Actual with S. E.	Percent		"t" (Diff. S. E.)	Probability P(t)
(1.1)	(1.2)	(1.3)	(1.4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Nadia ..	2839	1415	12	5.16 ± 0.40	6.41 ± 0.50	-1.25 ± 0.64	21.59	5.79	-1.95	0.06
Jessore ...	2915	1704	12	10.47 ± 0.44	10.54 ± 0.42	-0.07 ± 0.60	0.67	10.50	0.12	0.90
Rajshahi ...	2532	1235	11	11.87 ± 0.53	13.94 ± 0.53	-2.07 ± 0.76	16.03	12.91	-2.72	< 0.001
Bogra ...	1471	1471	13	17.14 ± 0.51	17.75 ± 0.50	-0.61 ± 0.72	3.50	17.45	-0.85	0.40
Tipperah ...	2536	2536	20	30.21 ± 0.45	26.20 ± 0.44	4.01 ± 0.63	14.22	28.20	6.37	< 0.001
Rangpur ...	3602	1095	9	31.74 ± 0.60	29.43 ± 0.56	2.31 ± 0.82	7.55	30.58	2.82	< 0.001
Mymensingh	6306	6306	50	26.02 ± 0.28	25.24 ± 0.27	0.78 ± 0.39	3.08	25.63	2.00	0.05
Dacca ...	2652	2652	32	25.03 ± 0.40	23.90 ± 0.40	1.13 ± 0.57	4.21	24.46	1.98	0.05
Total ...	24853	18414	159	22.21 ± 0.15	21.52 ± 0.15	0.69 ± 0.21	3.16	21.87	3.29	< 0.001

TABLE 11.
Observed Total Cost of Field Work in 1939 and in 1940.
(In hours per Square mile.)

Name of District	Den- sity of Grids.	1 - Acre			4 - Acre			9 - Acre			Proportional Cost in 1939 with 1940 = 100		
		1939		1940	1939		1940	1939		1940	1-acre	4-acre	9-acre
		Hours	Hours	No. of Grids	Hours	Hours	No. of Grids	Hours	Hours	No. of Grids			
(1)	(2)	(3-1)	(3-2)	(3-3)	(4-1)	(4-2)	(4-3)	(5-1)	(5-2)	(5-3)	(6-1)	(6-2)	(6-3)
Mymensingh ...	1.464	13.13	11.76	697	14.93	1 2.10	12988	16.54	15.05	944	112	123	110
Dacca ...	1.513	13.25	13.00	282	15.12	13.77	5160	16.98	14.18	375	102	110	120
Tipperah ...	1.306	12.75	10.45	294	14.31	11.70	4891	15.11	14.08	226	122	122	107
Rangpur ...	1.314	12.77	...	...	14.35	9.78	2284	15.19	14.13	94	...	147	108
Rajshahi ...	0.920	11.80	9.04	105	12.87	8.69	1628	11.46	8.53	44	131	148	134
Bogra ...	1.224	12.55	9.26	146	14.00	9.40	2920	14.37	13.55	245	136	149	106
Jessore ...	0.759	11.41	10.24	242	12.35	10.23	1831	11.21	9.00	264	111	121	125
Nadia ...	0.548	10.90	...	...	11.67	9.76	1294	10.96	...	...	...	120	...

APPENDIX III

NOTE BY THE SECRETARY DATED 22ND AUGUST, 1940,
ON SUBJECT NO. 48.—*To consider the programme of
work in connection with the Provincial Survey in 1941 for
Sampling Census of Jute.*

The field work in connection with the Sampling Census of Jute in eight principal jute districts of Bengal has been completed and the data collected are now being statistically examined. A preliminary report by Prof. Mahalanobis on this year's work will be circulated under Subject No. 47 of the Agenda. It is expected that the final report will be ready by November when it will be considered by the Jute Census Committee with a view to deciding the *detailed* Programme of work for a full scale Provincial Survey of the jute growing districts in Bengal proposed to be undertaken during 1941. The object of this Provincial Survey will be to try out the methods of random sampling developed on the basis of the Exploratory Surveys of the last few years, on a provincial scale, and also to ascertain the approximate aggregate cost of a Scheme of crop Forecasting based on the new technique. The members will be interested to know that the Experimental Provincial Survey of 1941 will represent the last stage in the Scheme for the Improvement of Jute Forecast which the Committee adopted at its first meeting in 1937. If the Experimental Provincial Survey of 1941 can be carried out successfully it is to be hoped that the improved technique of crop forecasting which the Indian Central Jute Committee, in collaboration with the Provincial Government, has been trying to evolve will be fully developed and the goal for which it set out in 1937 will be reached.

2. In the meantime as decided by the Jute Census Committee at its Tenth Meeting held on the 25th July, 1940, some preparatory work relating to next year's work, *viz.* the collection of

- | | |
|-----------------|-----------------|
| 1. 24-Parganas. | 11. Bogra. |
| 2. Nadia. | 12. Pabna. |
| 3. Murshidabad. | 13. Malda. |
| 4. Jessore. | 14. Dacca. |
| 5. Khulna. | 15. Mymensingh. |
| 6. Hooghly. | 16. Faridpur. |
| 7. Rajshahi. | 17. Bakarganj. |
| 8. Dinajpur. | 18. Tippera. |
| 9. Jalpaiguri. | 19. Noakhali. |
| 10. Rangpur. | |

Mauza Maps for the marginally noted 19 jute growing districts has been taken in hand and the remainder of the preliminary work will be started early in 1941. The co-

operation of the Government of Bengal has already been sought in connection with 1941

work and that Government has been requested to provide in their budget for 1941-42 a sum of Rs. 75,000 as a contribution to the Indian Central Jute Committee. It is hoped that the Provincial Government will extend their co-operation and give financial assistance as they have done in the past.

3. As regards the cost of the Provincial Survey it is not possible to give a detailed estimate until the material arising out of this year's work has been examined, but the Statistical Advisor (Prof. P. C. Mahalanobis) has estimated that the probable cost will not exceed Rs. 1,80,000 including the cost of preparatory work. The note attached to Subject No. 49 will show how it is proposed to raise this amount. Incidentally it may be added that this amount should not be taken to be the normal cost of the Provincial forecast based on the random sampling method that may be undertaken in future after the experimental work on the Scheme is over. The annual cost of such a forecast can be accurately estimated only after the data obtained from the Exploratory Provincial Survey of 1941 have been carefully examined and analysed. It is, however, anticipated that this cost will be substantially less than that of the next year's exploratory Provincial Survey.

4. To sum up the position :

- (a) it is proposed to undertake a full scale Provincial Survey in Jute districts in Bengal in 1941;
 - (b) the work for the collection of Maps required next year is proceeding;
 - (c) other preliminary steps in connection with the next year's work will be taken in due course; and
 - (d) the actual field survey will probably be started in March, 1941.
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APPENDIX IV

NOTE BY THE SECRETARY DATED 23RD AUGUST, 1940,
ON SUBJECT NO. 49.—*To consider (a) the final revised budget estimates of the scheme for the Improvement of Jute Forecast for 1940-41 and (b) budget estimates for 1941-42.*

(a) At its meeting held on the 8th March, 1940, the Indian Central Jute Committee sanctioned the budget estimates of the Scheme for the Improvement of Jute Forecast in Bengal for 1940 for Rs. 1,30,000 and provided a further sum of Rs. 30,000 for expenditure on preparatory work in connection with the Sampling Census of Jute on Provincial scale during 1941. The amount *viz.* Rs. 1,60,000 was made up of:—

(a) Available for the preparatory work for 1940 survey	Rs. 21,000/-
(b) Provided in the Indian Central Jute Committee budget for 1940-41	,, 62,500/-
(c) Contribution by the Government of Bengal	,, 62,500/-
(d) Amount obtained by transfer from the Committee's District Agricultural staff budget for 1940-41 (money value of the whole staff employed for the Jute Census work for about 4 months)	,, 14,000/-
	<u>Rs. 1,60,000/-</u>

A statement (I) is attached showing in parallel columns (i) the estimates of expenditure as sanctioned by the Committee under different heads and (ii) the estimates as now revised. It will be observed that the revised estimates of expenditure on 1940 Survey are within the total sanctioned amount even after providing for certain new items such as crop-cutting experiments in 1940, expenditure on the statistical analysis of the data of crop-cutting experiments in 1939 and arrear payment to the Indian Statistical Institute. The revised estimates of expenditure for 1940-41 are for the approval of the Committee (Statement II).

(b) *Budget estimates for 1941-42.*—As already explained in para. 3 of the note circulated under subject No. 48, it is not possible to give a detailed estimate of cost for 1941-42 until the material arising from the current year's cost has been examined, but the Statistical Adviser (Prof. P. C. Mahalanobis) has estimated that the probable cost will be Rs. 1,80,000 including the cost preparatory work. A sum of about Rs. 30,000 is already available in the budget of the Indian Central Jute Committee for the year 1940-41 which will be utilised for preparatory work in connection with the 1941 survey. As regards the balance of Rs. 1,50,000, the Government of Bengal has been requested to provide in their budget for the next financial year a sum of Rs. 75,000 as a contribution to the Indian Central Jute Committee for the Improvement of Jute Forecast.

A sum of Rs. 75,000 has accordingly been provided in the budget of the Indian Central Jute Committee for 1941-42 under scheme for the improvement of Jute Forecast (Statement III).

The detailed estimates for 1941-42 will be placed before the next meeting of the Indian Central Jute Committee.

D. L. MAZUMDAR,

Secretary.

STATEMENT I.

Detailed Revised Estimates of the Scheme for the "Improvement of Jute Forecast" for 1940-41.

Details.	Budget estimates as sanctioned by the Committee.	Revised Estimates.	Remarks.
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I. FIELD SECTION.

Pay of establishment ...	60 635	46,601	
Allowances ...	6,230	6,000	
Contingencies ...	2,000	5,650	
Pension and leave salary contribution of the Supervisor ...	...	400	
Area Extraction work ...	3,270	4,000	
Expenditure incurred on Preparatory Field work ...	6,000	7,800	
TOTAL ...	78,135	70,451	

II. MAPS.

Purchase of maps for 1940 work..	12,000	11,018	
Mounting a set of maps on linen..	4,000	4,715	
TOTAL ...	16,000	15,733	

III. CROP-CUTTING EXPERIMENTS.

1. Grant to the Statistical Institute for statistical analysis of data of crop cutting experiments, 1939 ...	...	1,440	
2. Field work of the crop-cutting experiment, 1940 ...	...	2,800	
3. Statistical analysis of data of crop-cutting experiments, 1940... ..	...	1,009	
TOTAL ...	...	5,249	

Details.	Budget estimates as sanctioned by the Committee.	Revised Estimates.	REMARKS
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IV. STATISTICAL SECTION.

1. Block grant to the Indian Statistical Institute :			
(a) For statistical analysis of 1940 figures ...	23,000	23,000	
(b) Model sampling experiments ...	5,000	5,000	
2. Overhead charges :			
(a) Statistical Adviser ...	6,000	6,000	
(b) Pay of lecturer in Presidency College ...	1,500	1,500	
(c) Telephone, Travelling, etc.	500	500	
TOTAL ...	36,000	36,000	

V. ADDITIONAL GRANT TO THE INDIAN STATISTICAL INSTITUTE.

1. Excess expenditure in connection with statistical work for 1939 scheme ...	...	1,367	
2. Arrear contribution to the Indian Statistical Institute for 1938 work ...	...	1,200	
TOTAL ...	...	2,567	

VI. PREPARATORY WORK FOR 1941 SURVEY.

Allotment for the preparatory work for 1941 survey ...	300,00	30,000	
TOTAL ...	30,000	30,000	

ABSTRACT

I. Field Section ...	...	...	70,451
II. Maps ...	...	...	15,733
III. Crop-cutting experiments ...	...	...	5,249
IV. Statistical Section ...	...	...	36,000
V. Additional grant to the Indian Statistical Institute ...	...	...	2,567
VI. Preparatory work for 1941 Survey ...	...	...	3,000
			1 60,00

STATEMENT II.

"SCHEME FOR THE IMPROVEMENT OF JUTE FORECAST".
Revised Budget Estimates for the year 1940-41.

Sub-heads.	Budget estimate for 1940-41.	Revised estimates for 1940-41.	Increase + Decrease-	Remarks,
Scheme for the Improvement of Jute Forecast in Bengal,	1,25,000 (a)	1,28,234* a)	+3,234	Increase is due to liabilities of Rs. 3,234/- for 1939-40. (a) includes Rs. 62,500/- contributed by the Govt. of Bengal.

*This excludes the following additional allotments for 1940 work and preliminary work for 1941 :—

- (i) Expenditure incurred during 1939-40 in connection with 1940 work. Rs. 17,766
- (ii) Amount obtained by transfer from the Committee's District Agricultural Staff budget for 1940-41 (money value of the whole staff employed on Jute Census work for about 4 months). Rs. 14,000
- Rs. 31,766

STATEMENT III.

"SCHEME FOR THE IMPROVEMENT OF THE JUTE FORECAST".
Budget Estimates for the year 1941-42.

Sub-heads.	Actuals for 1939-40.	Budget estimates for 1940-41.	Revised Estimates for 1940-41.	Budget Estimates for 1941-42.	Remarks.
Scheme for the Improvement of Jute Forecast in Bengal.	81,896-2-6	1,25,000	1,28,234	1,50,000 (a)	(a) This includes Rs. 75,000/- to be contributed by the Government of Bengal.