



# INDIAN CENTRAL JUTE COMMITTEE

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Proceedings of the Tenth Meeting

OF THE

## JUTE CENSUS COMMITTEE

HELD ON

*the 25th July, 1940.*

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Calcutta :

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1940.

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AGENDA FOR THE TENTH MEETING OF THE JUTE  
CENSUS COMMITTEE TO BE HELD ON THE 25TH  
JULY, 1940, AT 3-30 P.M.

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1. To confirm the proceedings of the last meeting of the Jute Census Committee held on the 3rd April, 1940.
2. To consider the Statistical Report on the crop-cutting experiments on Jute in 1939.
3. To consider a Scheme for conducting crop-estimating survey for Jute in 1940.
4. To consider the revised budget of the Field work of the Sampling Census of Jute, 1940.
5. To consider the preliminary progress report on the field work during the current season.
6. To consider the question of retention of the services of Mr. S. K. Banerji and Mr. D. M. Ganguli, Supervisor and Assistant Supervisor respectively up to the beginning of October, 1940.
7. To consider the question of addressing the Government of Bengal, Agriculture and Industries Department, about the Bengal Government's contribution towards the cost of the next year's work.
8. To consider the question of collection of maps as part of the preparatory work for the Provincial Survey to be undertaken in 1941.
9. Any other business.

D. L. MAZUMDAR,  
*Secretary.*

*The 17th July, 1940.*

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DRAFT PROCEEDINGS OF THE TENTH MEETING OF  
THE JUTE CENSUS COMMITTEE HELD AT  
CALCUTTA ON THE 25TH JULY, 1940, AT 3-30 P.M.

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PRESENT :

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

Mr. H. S. E. Stevens, C.I.E., I.C.S., Special Officer (Jute), Government of Bengal, and Mr. S. K. Banerji, Field Supervisor, also attended the meeting.

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SUBJECT NO. 1.—*To confirm the proceedings of the last meeting of the Jute Census Committee held on the 3rd April, 1940.*

The proceedings were confirmed.

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SUBJECT NO. 2.—*To consider the Statistical Report on the crop-cutting experiments on Jute in 1939. (Appendix I.)*

Mr. Townend said that, as a general rule, it seemed to him that all collected data even if it appeared firstly that they might be defective in the light of later information should be statistically examined, and not summarily thrown out.

The Secretary explained that when he suggested in his note that the statistical examination of last year's data might be left

out, if they were not already taken in hand, he did so primarily because there was no budget provision for this work, and also because an entirely new scheme of crop-cutting experiment was now proposed for the current year. However, in view of the fact that the statistical analysis had been already completed by Prof. Mahalanobis, this question did not arise.

Mr. Luke pointed out that from the word "Daisee" used by Prof. Mahalanobis in his Statistical Report, it was not clear what sort of jute was referred to there. "Daisee" was the name applied by the trade to jute growing in a particular area of Bengal, and if the word had been used in this sense in the Professor's Report, the attempted distinction between it and 'Tossa' appeared to be pointless. He suggested that the terms '*Olitorius*' and '*Capsularis*' should, in future, be used in the Report.

Mr. Sen said that at Dacca the practice was to name the 'Daisee' as 'Capsularis'.

Prof. Mahalanobis said that actually he had no knowledge of what was meant by 'Daisee' jute. He had only the field books to go upon. But in course of his analysis, he had noticed little difference between 'Daisee' and 'Tossa'.

The Secretary said that, going through the Report, he had formed the impression that 'Daisee' was used to distinguish it from 'Tossa'. 'Tossa' was a very definite variety *viz. Olitorius*, and, whatever was not 'Tossa' seemed to have been called 'Daisee'.

Mr. Townend suggested that the Report might go as it stood but, for the next year, they must be definite about it.

The Secretary was of the opinion that they should not go by trade names and thought that it would be better if they confined themselves to scientific terms, *viz. 'Olitorius'* and '*Capsularis*'.

After further discussion it was agreed that this matter be cleared up; and in the next Report the words '*Olitorius*' and '*Capsularis*' should be used instead.

As the estimated cost of Rs. 1,400/- for expenses in this connection was provided for in the revised budget of the Field work of the Sampling Census of Jute, 1940, (Item No. 4 of the agenda), it was unanimously sanctioned.

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SUBJECT NO. 3.—*To consider a scheme for conducting crop-estimating survey for Jute in 1940. (Appendix II.)*

The Secretary said that he had no comments to make except what he had already stated in his note. He added that Prof. Mahalanobis had issued detailed instructions to the workers in Bengali, and would be pleased to explain them to the members if they so desired.

Referring to para. 6 of Prof. Mahalanobis's note, Mr. Townend wanted to know whether it was worthwhile trying to establish any correlation between the girth and height of the plants and the yield of the fibre. Mr. Stevens was also sceptical of the usefulness of these measurements, and pointed out that the accumulation of unnecessary data might, in the end, unduly increase the cost of their analysis.

Prof. Mahalanobis replied that in the case of certain plants, *e.g.* Cinchona, that was the only method that was followed. The measurements of girth and height would not involve any extra expenditure as the work would not be done on the field, but only after the plants had been cut and removed for retting. As the plants would then have to wait for retting, no additional expenditure would be incurred. Only a few measurements at random would be taken.

Mr. Sen thought that there might be some point in trying to find out if there was any correlation between girth and yield. For, according to an indigenous system of measurement, this factor was taken into account in arriving at a rough estimate of yield.

The Chairman enquired whether Prof. Mahalanobis could not, at this stage, give a more definite estimate of the cost of the proposed crop-cutting experiment.

Prof. Mahalanobis regretted that he was unable to do so. Unfortunately, last year, the work was done in such a way as not to furnish data for calculating costs. This year, what they were going to do was to take cost figures, and accordingly, arrangements would be made, along with the crop-cutting experiments, for keeping a detailed record of the time required at each stage of the work in order to enable a preliminary study

being made of the cost function. It was also proposed to study, in a tentative way, the variance function on the basis of the records for sub-cuts of different sizes. He hoped that the preliminary work done this year would enable a Scheme being prepared for an exploratory survey on a larger scale in 1941. The whole work, he thought, would be completed in course of a month, the field portion of it taking not more than 14 days. As illustrations of the proper scale of expenditure for crop-cutting experiments, he said he might inform the Committee that he was doing two Schemes for the U. P. Government, one on Sugar at a cost of Rs. 17,000 and the other on Wheat at a cost of Rs. 30,000. The figures that he had given on his present Scheme were only approximate. They might require substantial modification in the light of the actual experience gained on the field.

The Chairman suggested that, if during the progress of the scheme it was found that any substantial modifications should be made, they should be submitted to the Committee and discussed.

Prof. Mahalanobis said that there would be no time for this as the field work would have to be finished in about 14 days and that there were only two practicable ways of financing the Scheme. Either they could fix up a limit or they could leave the matter to be decided by the Secretary in consultation with him.

After further discussion, it was agreed that if any substantial modification in the estimates was called for, the matter would be decided by the Secretary, in consultation with the Vice-President.

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SUBJECT NO. 4.—*To consider the revised budget of the Field work of the Sampling Census of Jute, 1940. (Appendix III.)*

The Secretary said that Prof. Mahalanobis had circulated an additional note (Appendix VIII) on this subject which was laid on the table. The entire position had been reviewed in his note and the financial effects of the proposals had been summarised in para. 6 of it.

Referring to item 5(b), Mr. Townend said that he was not persuaded by Prof. Mahalanobis's logic that because the Statistical

Institute had to refund unspent balances, the Committee should re-imburse it for any excesses of expenditure that was incurred. He would have liked to know more about this excess.

The Secretary pointed out that the grant made to the Statistical Laboratory was in the nature of a block grant, and it was not possible for this office to scrutinise the expenditure in detail. The Audit Report submitted by the Professor would show in a general way how the expenditure was incurred, but it would not show under which head the excess occurred.

After some further general discussion about the grants to the Statistical Laboratory, the revised budget estimates were approved.

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SUBJECT NO. 5.— *To consider the preliminary progress report on the field work during the current season. (Appendix IV.)*

The Secretary enquired when the field work in connection with the area-survey would be over.

Mr. Banerji, Field Supervisor, informed the Committee that all their work would be completed by mid-July except two units which were taken up later and were expected to be completed by the end of August.

Prof. Mahalanobis said that they had completed an area of 22,000 sq miles out of 24,000 sq. miles. They had left out 2,000 sq. miles in order to make a saving for expenditure on crop-cutting experiments.

In reply to Mr. Sen, Prof. Mahalanobis further stated that this was merely an exploratory work, and it did not matter if they had left out 2,000 sq. miles, which were mostly *Char* areas.

Mr. Sen enquired if they could compare the accuracy of the results obtained with the Registration Scheme figures, as these would afford at least some amount of check in respect of the 8 districts surveyed.

Mr. Stevens informed the Committee that the Registration figures had not yet been compiled and could not be had for some



time to come. The figure of 1939 Registration Scheme had been already sent to this office.

The preliminary progress report on the Field work was thereupon approved.

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SUBJECT NO. 6.—*To consider the question of retention of the services of Mr. S. K. Banerji and Mr. D. M. Ganguli, Supervisor and Assistant Supervisor respectively up to the beginning of October, 1940. (Appendix V.)*

Prof. Mahalanobis pointed out that provision for the retention of these two officers had been made in the revised budget, and they had already approved of the budget, under item No. 4.

It was thereupon decided that the Government of Bengal be requested for the retention of the services of Mr. S. K. Banerji, Field Supervisor, with the Committee, up to the beginning of October, 1940. Similarly, the retention of the services of Mr. D. M. Ganguli, Assistant Field Supervisor, for the same period was approved.

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SUBJECT NO. 7.—*To consider the question of addressing the Government of Bengal, Agriculture and Industries Department, about the Bengal Government's contribution towards the cost of the next year's work. (Appendix VI.)*

Mr. Stevens said that there was no definite estimate for the Government to consider.

The Chairman pointed out that it was proposed to provide Rs. 75,000 in the Committee's budget for the next year's work and to request the Government of Bengal to include an equal amount in their budget.

Mr. Stevens said that if the Committee was satisfied that the figure of Rs. 1,30,000 would not have to be increased, there was no harm in asking the Government to provide for their share of contribution in their next year's budget. Now was the time when the Government of Bengal should be approached with the proposal. But he thought that the Committee should give details.

Prof. Mahalanobis said that it was difficult to give details at that stage. He would, however, inform the Committee that what he was aiming at was to get an annual census by the sampling method at a cost not exceeding Rs. 1,50,000. He feared that cutting down the estimates for next year's work might affect the quality of work.

Mr. Sen doubted if the sampling method was any good if they were not sure to get a figure on which they could depend.

Prof. Mahalanobis said that he was trying to reduce the margin of error to 4 or 5 per cent. This was by no means a substantial margin.

The Chairman enquired whether it would be possible later on to give a more detailed estimate, and whether it would be too late then to address the Government of Bengal.

The Secretary said that the provision should go into the Schedules of the Agriculture Department. They are usually submitted to the Finance Department in August-September. Hence the sooner they approached the Government of Bengal the better for them.

Mr. Stevens concurred in this view and enquired if the figure which was quoted—Rs. 1,50,000—was sufficient for Prof. Mahalanobis.

Prof. Mahalanobis said that he hoped to obtain a fairly accurate forecast with a margin of error of the order of 4 to 5 per cent. That would perhaps be a satisfactory order of accuracy.

It was thereupon decided that Rs. 75,000/- should be provided by the Committee for the "Scheme for the Improvement of the Jute Forecast" in its budget for 1941-42, and that the Government of Bengal should be requested to provide for a similar amount in their budget for the next financial year.

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SUBJECT NO. 8.—*To consider the question of collection of maps as part of the preparatory work for the Provincial Survey to be undertaken in 1941.* (Appendix VII.)

The Chairman pointed out that Prof. Mahalanobis agreed entirely with the proposal of the Secretary, as embodied in his

note on the subject, that the work of the collection of maps for the next year's Provincial Survey should be undertaken by a small staff immediately after the field work in connection with the area-survey was over in the beginning of August. As the next year's field operations would cover all the important jute-growing districts of the Province, a much larger number of cadastral maps would have to be collected this year than they were in the last. It was therefore very necessary that this work of the collection of maps should be taken in hand at the earliest opportunity, so that the work at the Statistical Laboratory might be completed in good time and the field operations for the Provincial survey of 1941 might start at the earliest possible date. The Secretary had estimated the cost of this work at Rs. 1,500. He had proceeded on the assumption that maps for only twelve districts would be necessary, but since maps would also be required for the eight districts in which work was being done this year, the estimate should be proportionately increased to Rs. 2,500.

The proposal was agreed to.

The Secretary said that, in this connection, he wanted to clear up one point, *viz.* the number of districts for which maps were to be purchased.

It was agreed that maps for all the districts except Burdwan, Midnapore, Howrah, Darjeeling and Chittagong should be purchased, and the surveys would be undertaken in these districts only.

The meeting then terminated.

D. L. MAZUMDAR,

*Secretary,*

*Indian Central Jute Committee.*

*The 29th July, 1940.*

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**APPENDIX I**

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NOTE BY SECRETARY DATED THE 17TH JULY, 1940,  
ON SUBJECT NO. 2.—*To consider the Statistical Report  
on the crop-cutting experiments in Jute in 1939.*

It will be recalled that some crop-cutting experiments were conducted in 1939 under the control of the Director of Land Records and Surveys, Bengal. Prof. Mahalanobis has explained to the Secretary that the general idea of that work was supplied by the Statistical Laboratory but the latter did not have any opportunity of examining the details of the field programme or the instructions that were issued to Investigators. The results of the experiments were handed over to the Laboratory, but no money was provided in the budget for the statistical analysis of the material. In view of the importance of the work, Professor Mahalanobis has carried out a general analysis on the basis of which he is writing a report which will be circulated to the members of the Committee as soon as it is received. Professor Mahalanobis has stated that it will be necessary to provide about Rs. 1,400 for expenses in this connection. This amount is presumably required for the detailed analysis of the data collected in 1939. It is not clear from Prof. P. C. Mahalanobis's Note if he has already taken this work in hand. As the Professor is away from Calcutta, the Secretary has been unable to ascertain the position definitely. If no work has yet been done in this matter, it is to be considered whether it is worth the Committee's while, at this stage, to ask him to engage in this work. In view of the fact that a fresh scheme for crop-cutting experiments is now proposed, it does not appear to be necessary to incur the expenditure of Rs. 1,400 on last year's data, which were admittedly defective. If, however, Prof. Mahalanobis has already completed this work, the estimated cost of Rs. 1,400 may be sanctioned. The Committee will be in a position to ascertain the present position with regard to this work from the Professor on the date of the meeting\*.

The subject is for the consideration of the Jute Census Committee.

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\*Prof. Mahalanobis's Statistical Report on the crop-cutting experiments has since been received. Steps are being taken to circulate copies of it among the members. (Enclosure).

**ENCLOSURE**

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**STATISTICAL REPORT ON CROP-CUTTING EXPERIMENTS ON JUTE: 1939.**

By P. C. Mahalanobis

**Section 1. INTRODUCTION AND DESCRIPTION OF FIELD WORK.***Introduction*

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Crop-cutting experiments on a small scale were carried out along with the random sample survey of the area under jute in 1939 under the direction of Rai Bahadur N. C. Sen, Director of Land Records and Surveys, Bengal, and the supervision of Mr. N. C. Chakravarti, Deputy Magistrate and Supervisor, Jute Census Scheme. The work done was admittedly of an experimental nature and was undertaken to study the technique of this type of survey. I had broadly indicated the procedure and had suggested using samples of different size (area) and the keeping of detailed time records with a view to studying the variance and the cost functions. The decision to start the crop-cutting was made early in July 1939, but a little later I was obliged to leave for Bombay to attend the meetings of the Indian Central Cotton Committee. I was therefore unable to look into the details of the scheme or to examine the forms and schedules for the field work or the instructions to investigators which were prepared by the Field Branch. I am giving below extracts from the report on the field work which was sent to me by Mr. N. C. Chakravarti on the 10th July 1940\*

*General Description of the Field Work*

2. The experiment was conducted in 22 different localities, selected at random, in 6 thanas (Police Stations) in 4 districts (Mymensingh, Rangpur, Pabna and 24 Parganas). A list of localities is given in Table (1). Attempts were also made to carry out the work in Hooghly district but the jute was not fit for harvesting at the close of the field operations.

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\*I have condensed the report to some extent and have made necessary verbal alteration for this purpose.

3. 23 types of samples were used in each unit of which 3 were of size 66 square feet, 4 of 33 square feet, 3 of 22 square feet, 6 of 11 square feet and 6 of 5.5 square feet; 19 of these types were of square shape and 4 circular. One sample each of 66 square feet, 33 square feet and 22 square feet was collected in 6, 3 and 2 sub-cuts of 11 square feet each; in another set, one sample each of 66, 33 and 22 square feet was made up of 6, 3 and 2 sub-samples each of size 11 square feet taken at random from within the same plot. Each sample or sub-sample was located at random within each plot of land by a method devised in the Statistical Laboratory.

4. The field work consisted of the following stages:—

- (1) Selection of plots from a list of random plots.
- (2) Obtaining permission from owners to cut jute in the selected plots.
- (3) Location of the samples and sub-samples within each plot; cutting of jute and taking measurements.
- (4) Carrying and steeping the jute plants.
- (5) Stripping, drying and taking measurements of the dry fibre and sticks.

5. Besides the Jurisdiction List Number of the village and the Revenue Number of the plot from which the sample is collected and the type and size of samples, the following measurements were recorded in the field book:—

- (1) Green weight of plants.
- (2) Total number of plants.
- (3) Length of plant (single reading).
- (4) Circumference at mid-height of plant (single reading).
- (5) Weight of dry fibre.
- (6) Weight of dry sticks.
- (7) Length of fibre (single reading).

The interval between cutting and taking the green weight, and between steeping and stripping as also the time allowed for drying

the fibre were also recorded; and time and cost records were kept for each unit as a whole.

6. The selection of plots was a difficult job. A large number of plots in the random list had to be examined for this purpose, for it was often found that some of the plots did not have any jute on them; in some cases the jute was not fit for cutting; while in other plots the jute had been already harvested. After the preliminary selection of plots in which jute was in proper condition for being cut it was necessary to find out the owners and to secure their permission. Considerable difficulty was experienced at this stage; some of the owners lived in distant villages, and some times two or three visits had to be paid to meet and persuade them; in some cases owners refused to give consent on the plea that they could not do so without consulting absentee co-sharers; in the case of plots let out in Barga, the consent of both the Bargadar and the owner had to be obtained. All this meant rejecting a large number of plots given in the random list; for example, in one village 182 plots had to be examined in order to secure the required 23. Compensation on the basis of the estimated price of jute was offered and was given in about half the cases.

7. The date and time of cutting the jute had to be usually fixed to suit the convenience of the owner or his representative who wanted to be present to see that no damage was done to the remaining portion of the crop. It was found that in collecting the samples and in taking measurements slight damage was done to some of the plants but this was usually negligible.

8. The measurement and cutting did not prove difficult except in a few places where the field was under water. The Inspectors selected for the work were given practical training by demonstration by Mr. N. C. Chakravarti; and the Investigators were trained by the Inspectors. The field work up to the stage of preliminary measurement of the area and the placing of pegs was done by Investigators, but the cuts and measurements on jute were made by Inspectors after verification of the area of the sample.

9. The jute could not be steeped locally owing to the difficulties in guarding the plants during the period they were kept under water. Arrangements were therefore made for carrying the

jute plants to Inspectors' camp, and steeping in a pond hired for this purpose; this was quite expensive where the selected villages were at some distance from the camp. In some places hiring of a pond also proved difficult as the steeping of jute plants pollutes the water to a marked degree; these difficulties were however overcome by the Inspectors.

10. Instructions had been originally given to cut all the jute plants in one village on the same day; this however was not possible in practice. It was found that for each unit it took two or three days for the Inspectors to verify the area of the samples and sub-samples, to cut and tie the plants in separate bundle, to carry them to camp, and to take the measurements before steeping.

11. Another factor which increased the cost of operations to a great extent was the waste of man power during the time the jute was steeped as it required from 9 to 15 days to finish the process during which time the Inspectors were mostly sitting idle. This waste may be avoided to some extent by giving the Investigators a sufficiently large area which would keep them engaged for about fifteen days in cutting the various samples so that by the time the last cut is made the first sample would be ready for being stripped and washed. Even then the Inspectors would not have enough work in the later stages as the stripping and washing has to be done by day labourers.

12. Mr. Chakravarti in his report made special mention of the work done by Messrs. C. R. Barori, S. C. Chakravarty, S. C. Chatterjee and K. M. Bhattacherya as Inspectors. The Director of Land Records and Surveys, Bengal, inspected actual crop-cutting work in Gaibandha, and Mr. N. C. Chakravarti inspected the work in Rangpur and Jamalpur.

#### *General Remarks*

13. I have made a fairly detailed analysis of the records relating to the green weight of plants, number of plants and the weight of dry fibre. It was not possible to make any use of the records relating to the height and circumference of plants or length of fibre as only a single reading was available for each sample in these cases. The time and cost records unfortunately were given for each Field Unit as a whole, and were therefore not



of any use for studying the cost for different sizes of samples or for such components of the cost as journeys from one sample to another. Besides this, the time and cost records were incomplete in many respects; for example, there were no records of the time required for steeping in Pabna and Rangpur, or for carrying in Kishoreganj besides other gaps in the data. In Rangpur (Sadar) the name of variety of jute was missing in every case. From the statistical point of view the main results thus relate to the mean yield of jute in the different localities; the correlations between the weight of green plants, weight of dry fibre, and number of plants; and also in a tentative way to the variance function.

14. The bulk of the calculations was carried out in the Statistical Section under the supervision of Babu Sambhu Nath Haldar. I should also like to mention the help given by Mr. Mohonlal Ganguli, one of the Senior Workers of the Statistical Laboratory, in connexion with the work on variance function; he worked out the necessary formulae and made many of the calculations.

## Section. 2. MEAN VALUES AND COEFFICIENTS OF VARIATION.

15. We have made straight forward calculations of the mean values, standard deviations, and co-efficients of variation (*i.e.*, percentage ratio of the standard deviation to mean value) for the weight of green plants, the number of plants, and the weight of dry fibre separately for the two varieties "deshi" and "tosha" jute. In the case of weight of green plants and the weight of dry fibre the values are given in maunds per acre, and in the case of number of plants the values shown are in thousand plants per acre. The results are given in Tables (2·1)—(2·6) the form of which are exactly similar. In every case col. (1) shows the serial number of the Field Unit; col. (2) the number of samples on which the mean values are based; col. (3) the mean values together with corresponding standard errors; col. (4) the standard deviations; and col. (5) the corresponding co-efficients of variation. Besides the results for each Field Unit, mean values for each thana are also given in each case. The results for Sadar thana in Rangpur district are given at the bottom of Tables (2·1), (2·3) and (2·5) for "deshi" jute. It must be remembered, however, that the variety of jute was not mentioned in the case of this thana; and hence the results are ambiguous as they may

refer to either "deshi" or "tosha" or to a mixture of both the varieties.

16. As regards the weight of green plants it will be noticed that there is considerable variation from one Unit to another. For example from Table (2·1) we find that in the case of "deshi" jute in Jamalpore thana in Mymensing district the mean value fluctuates from 173 maunds per acre in Unit No. 2 to 303 maunds per acre in Unit No. 3; in Kishoreganj thana in Mymensingh district it varies from 125 maunds in Unit No. 27 to 193 maunds in Unit No. 28; and in Gaibandha thana in Rangpur from about 157 maunds in Unit No. 17 to 260 maunds per acre in Unit No. 14. The variation is equally large in the case of "tosha" jute; and it will be noticed from table (2·2) that the mean value fluctuates from 129 maunds in Unit No. 15 to 253 maunds in Unit No. 4. in Jamalpore thana; from 123 maunds in Unit No. 6 to 246 maunds per acre in Unit No. 7 in Kishoreganj; from 204 maunds in Unit No. 14 to 307 maunds per acre in Unit No. 9 in Gaibandha; and from 226 maunds in Unit No. 23 to 311 maunds per acre in Unit No. 19 in Pabna Sadar.

17. In the case of "deshi" jute the co-efficient of variation for weight of green plants fluctuates from 31 per cent to nearly 85 per cent in case of individual Field Units; but varies from 46 to 59 per cent for mean values for thanas. In the case of "tosha" jute the co-efficient of variation appears to be a little smaller. It varies from 32 to less than 70 per cent in the case of individual Field Units; and roughly from 37 to 47 per cent in the case of thana means. The percentage variability in the case of "tosha" is lower mostly because the actual standard deviations are smaller.

18. The variation in the number of plants per acre is slightly smaller than the variation in the weight of green plants. In the case of "deshi" jute it varies from about 133 thousand per acre in Unit No. 4 to 178 thousand in Unit No. 15 in Jamalpore; from 103 thousand in Unit No. 27 to 135 thousand in Unit No. 8 in Kishoreganj; and from 93 thousand in Unit No. 17 to about 140 thousand in Unit No. 9 in Gaibandha thana in Rangpur. For "tosha" jute the number of plants fluctuates from 72 thousand in Unit No. 2 to 225 thousand in Unit No. 11 in Jamalpore; from 90 thousand in Unit No. 6 to 124 thousand in Unit No. 7

in Kishoreganj; from 93 thousand in Unit No. 14 to about 158 thousand per acre in Unit No. 9 in Gaibandha; and from 115 thousand in Unit No. 23 to 169 thousand in Unit No. 19 in Pabna Sadar. The co-efficient of variation for thana means fluctuates from 34 to 47 per cent in the case of "deshi" jute; and from 29 to 54 per cent in the case of the "tosha" variety.

19. The variation in the weight of dry fibre is also fairly large. In the case of "deshi" jute the mean yield varies from 18 maunds per acre in Unit No. 11 to 26 maunds per acre in Unit maunds in Unit No. 28 in Kishoreganj; and from 15 maunds in Unit No. 9 to 27 maunds in Unit No. 14 in Gaibandha. For the "tosha" variety the mean yield varies from 13 maunds per acre in Unit No. 3 to over 31 maunds per acre in Unit No. 4 in Jamalpore; from 11 maunds in Unit No. 8 to nearly 19 maunds per acre in Unit No. 7 in Kishoreganj; from 17 maunds in Unit No. 14 to nearly 27 maunds per acre in Unit No. 17 in Gaibandha; and from about 14 maunds in Unit No. 22 to over 17 maunds per acre in Unit No. 19 in Pabna Sadar.

20. The co-efficient of variation in the case of dry fibre of "deshi" jute fluctuates from about 20 per cent in Unit No. 11 to about 153 per cent. in Unit No. 27; while the percentage variability for thana means varies from 47 per cent in Jamalpore to 95 per cent in Kishoreganj. The values for Unit Nos. 27 and 28 in Kishoreganj are 93 and 153 per cent respectively and look abnormal; omitting this thana the highest co-efficient of variation of 54 per cent occurs in Gaibandha. In the case of "tosha" jute the co-efficient of variation fluctuates from about 18 per cent in Unit No. 22 to 74 per cent in Unit No. 15; and for thana means from 31 per cent in Barasat to 53 per cent in Kishoreganj.

21. The most interesting result which emerges from the mean values discussed above is the comparatively moderate range of variation in the case of all three variates, namely, the weight of green plants, number of plants, and weight of dry fibre. In the case of "tosha" jute we find that for thana means the percentage variability fluctuates from a little over 30 per cent to a little over 50 per cent in all the three cases. For "deshi" jute the co-efficient of variation for thana means fluctuates from 46 to 59 per cent in the case of weight of green plants; from 34 to 47 per cent in the

case of number of plants per acre; and from 47 to 54 per cent (omitting Kishoreganj) in the case of weight of dry fibre. Broadly speaking the range of variation is confined between 30 and 60 per cent on the whole.

### Section 3. CORRELATION BETWEEN CHARACTERS.

22. We have worked out the co-efficients of correlation between the three characters, weight of dry fibre in maunds per acre, weight of green plants in maunds per acre, and the number of plants in thousands per acre. Owing to the fact that only single readings were available for the height and girth of green plants and the length of fibre it was not possible to make any use of the measurements of these three characters.

23. Besides the co-efficient of correlation the constants for linear regression equations have also been worked out, and the results are given in Tables (3·1)—(3·6). The form of these tables is identical; col. (1) gives the serial number of the field Unit; col. (2) the number of samples on which the results are based; col. (3) the co-efficients of correlation which are all positive with exception in Table (3·1), Unit No. 6; Table (3·2), Unit No. 6; Table (3·3), Unit Nos. 14 and 28; Table (3·5), Unit No. 6; and Table (3·6) Unit Nos. 3 and 8, in which the negative sign has been used. The next two columns (4) and (5) give the values of constants 'a' and 'b' in the linear regression equations of the type  $y = a + b(x)$ , where 'y' represents the weight of dry fibre in maunds per acre in Tables (3·1), (3·2), (3·3) and (3·4) and 'x' represents the weight of green plants in maunds per acre in Tables (3·1) and (3·2), and the number of plants in thousands per acre in Tables (3·3) and (3·4); again 'y' is the weight of green plants in maunds per acre and 'x' the number of plants in thousands per acre in Tables (3·5) and (3·6). Co-efficients of correlation which are significant on the one per cent level are marked with two stars (\*\*); and those significant on the five per cent with a single star (\*).

24. The co-efficients of correlation between the weight of dry fibre and the weight of green plants are mostly significant. The actual value in the case of "deshi" jute varies from 0·49 in Unit No. 2 to 0·91 in Unit No. 15 in Jamalpore; and, neglecting a statistically insignificant negative value in the case of Unit No. 6

from 0·47 in Unit No. 27 to 0·98 in Unit No. 8 in Kishoreganj; and from 0·62 in Unit No. 14 to 0·97 in Unit No. 17 in Gaibandha. For "tosha" variety the co-efficient of correlation in Table (3·2) varies from 0·50 in Unit No. 1 to 0·95 in Unit No. 3 in Jamalpore; neglecting a statistically non-significant negative value, from 0·53 in Unit No. 8 to 0·85 in Unit No. 28 in Kishoreganj; from 0·89 in Unit No. 22 to 0·97 in Unit No. 23 in Pabna Sadar; and its value in 0·79 in Barasat and 0·93 in Gaibandha. In the case of dry fibre and green plants the co-efficient of correlation thus varies from 0·47 to 0·98 in individual units; and the values are usually high and above 0·6.

25. The co-efficient of correlation between the weight of dry fibre in maunds per acre and the number of plants in thousands per acre are shown in Tables (3·3) and (3·4). Owing to the small number of samples, values of individual co-efficients do not usually reach the five or one per cent level of significance. However, with the exception of two cases in the case of "Deshi" Jute the co-efficients are all positive; and the thana values are usually significant. This shows that there exists a real positive correlation between these two characters which however is only moderate in magnitude. Actual values of the co-efficients fluctuate from 0·30 to 0·74 in Jamalpore; from -0·27 to 0·80 in Kishoreganj; from -0·02 to 0·51 in Gaibandha for "deshi" jute and from 0·02 to 0·90 in Jamalpore; from 0·13 to 0·81 in Kishoreganj; from 0·35 to 0·81 in Pabna, and are of the order of 0·5 in Gaibandha and Barasat for "tosha". The correlation between weight of dry fibre and number of plants per acre is appreciably lower than the correlation between weight of dry fibre and weight of green plants, but may still be of some use in improving the estimate of dry fibre.

26. Tables (3·5) and (3·6) show the correlation between weight of green plants in maunds per acre and the number of plants in thousands per acre. Here also the co-efficients are mostly insignificant on the one or five per cent level. However, with the exception of two values they are all positive; but the numerical values are even lower than those in the case of the correlation between weight of dry fibre and number of plants. the pooled values for thanas vary from about 0·22 to 0·60.

27. In view of the fact that the number of samples is usually small in the case of individual Field Units I have thought

it desirable to calculate average values of the correlation with the help of R. A. Fisher's 'z' transformation. The results are given in Tables (3·7) – (3·9) in which col. (1) shows the name of thana; col. (2) the number of samples; col. (3) the number of Field Units; and col. (4) the total degrees of freedom. The average value of Fisher's 'z' is shown in col. (5) and the corresponding equivalent co-efficient of correlation in col. (6).

28. From Table (3·7) it will be noticed that the average value of co-efficient of correlation between the weight of dry fibre in maunds per acre and the weight of green plants in maunds per acre in case of "deshi" varies from 0·73 in Jamalpore to 0·79 in Gaibandha, and is about 0·75 for all thanas combined. The average value of the same correlation in the case of "tosha" jute varies from 0·71 in Kishoreganj to nearly 0·94 in Pabna Sadar; and the combined value for all thanas is 0·85. If we pool together the material for both "deshi" and "tosha" jute the average value of the correlation between dry fibre and green plants is over 0·82. We may conclude, therefore, that there is a high positive correlation between weight of dry fibre and weight of green plants which may enable a preliminary estimate of the yield of dry fibre being made from the knowledge of the weight of green plants.

29. Table (3·8) shows the average values of the co-efficient of correlation between the weight of dry fibre in maunds per acre and the number of plants in thousands per acre. For "deshi" jute the average value in individual thanas varies from 0·28 to 0·53 and the pooled value is 0·43; while for the "tosha" variety the value in individual thanas fluctuates from 0·35 to 0·69, the pooled value being 0·53. Combining the two varieties we get an average value of 0·49.

30. Similarly Table (3·9) shows the average results for the correlation between the weight of green plants in maunds per acre and the number of plants in thousands per acre. The value for individual thanas ranges from 0·32 to 0·41 for "deshi" jute, and from 0·23 to 0·53 for "tosha" jute. The pooled value is 0·37 for the "deshi" and 0·35 for the "tosha" variety; while the combined value is 0·33.

31. We may sum up the results obtained in this Section in the following way. The correlation between the yield of dry fibre and weight of green plants is high and of the order of 0·8;

between dry fibre and number of plants the correlation is moderate and of the order of 0·5; while the correlation between weight and number of green plants is still lower and of the order of 0·33.

#### Section 4. STUDY OF VARIANCE: WEIGHT OF DRY FIBRE.

32. It will be remembered that the present experiment was carried out in six Thanas (Police Stations) with five different sizes of samples, namely 66 square feet, 33 square feet, 22 square feet, 11 square feet and 5·5 square feet. Arrangements were made for collecting all five sizes from each Thana; but the number of samples of each size replicated in a Thana was not constant from one Thana to another. The actual distribution of samples is shown in Table (4·1).

TABLE (4·1).

Distribution of Samples by Size and Police Stations

Name of Thana	Size of Samples in square feet				
	66	33	22	11	5·5
Kishoreganj ...	15	20	20	30	30
Pabna ...	9	12	12	17	16
Barasat ...	3	3	2	2	2
Gaibandha ...	9	12	12	18	18
Jamalpur ...	21	28	28	42	42
Rangpur ...	9	12	12	18	18
<b>TOTAL</b> ...	<b>66</b>	<b>87</b>	<b>86</b>	<b>127</b>	<b>126</b>

33. In order to study the variation in yield from one Thana to another we may carry out in the first instance an analysis of variance for the weight of dry fibre separately for each size (area) of samples. The results are shown in Table (4·2). It will be noticed that the variation between Thanas comes out as significant in the case of 66 square feet, 11 square feet (on the one per cent. level) and possibly 5·5 square feet (on the five per cent. level);

but is apparently insignificant for 33 and 22 square feet. This result suggests the presence of heterogeneity in the material.

34. We can carry out a similar analysis by pooling together the results for the different sizes of samples after reduction to a standard size of 11 square feet. The analysis of variance is shown at the bottom of Table (4'2). The differences in mean yield between Thanas are definitely significant for the pooled material.

35. We know, however, that the number of samples within different Thanas was not equal for each size; it will be desirable, therefore, to eliminate the effect of such inequality in the number of samples. Let  $V_1$  be the observed variance "within Thanas" and  $V_2$  the observed variance "between Thanas"; values of which are given in Table (4'2); let the estimated variance "within Thanas" be written as  $(s_1)^2$  and the estimated variance "between Thanas" as  $(s_2)^2$ ; and let  $n_i$  be the number of samples in the  $i$ -th Thana,  $N$  the total number of samples equal to  $\sum (n_i)$  and  $K$  the number of Thanas, in this case, six. We know then

$$V_1 = (s_1)^2 \dots \dots \dots (1)$$

$$(K-1)(V_2 - V_1) = \left\{ N - \frac{\sum (n_i)^2}{N} \right\} (s_2)^2 \dots \dots \dots (2)$$

36. Using the above expressions it is easy to calculate the actual values of  $s_1$  and  $s_2$  in the different cases; we have also calculated the values of  $s_3$  the standard deviation corresponding to the total variance. For facility of comparison we have reduced the mean yields and standard deviations to maunds per acre in every case. The results are shown in Table (4'3) in which col. (1) shows the size (area) of samples; and col. (2) the mean yield of dry fibre in maunds per acre. The degrees of freedom for variations "within Thanas" ( $f_1$ ), "between Thanas" ( $f_2$ ), and total variation ( $f_3$ ) are shown in columns (3), (5) and (7); while the corresponding standard deviations in maunds per acre are given in columns (4), (6) and (8) respectively; finally, the corresponding co-efficients of variations  $c_1$ ,  $c_2$  and  $c_3$  have been shown in columns (9), (10) and (11) respectively.



TABLE (4-3)

Statistical Constants for different Sizes of Samples

Size of Samples	Mean Yield	Within Thana		Between Thana		Total Variation		Coefficient of Variation		
		$f_1$	S. D.	$f_2$	S. D.	$f_3$	S. D.	$c_1$	$c_2$	$c_3$
		(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1)	(2)									
66 sq. ft. ...	16.08	60	6.55	5	3.51	65	7.27	40.74	21.81	45.21
33 sq. ft. ...	16.19	81	7.38	5	0.82	86	7.41	45.54	5.04	45.77
22 sq. ft. ...	14.10	80	6.40	5	1.10	85	6.48	45.41	7.77	45.96
11 sq. ft. ...	17.52	121	8.08	5	3.79	126	8.75	46.12	21.61	49.94
5.5 sq. ft. ...	23.98	120	13.41	5	4.28	125	13.98	55.93	17.85	58.30
All Sizes ...	18.15	486	9.05	5	4.97	491	10.30	54.87	22.53	56.72

37. We find that the co-efficient of variation "within Thanas" fluctuates from about 41 to 56 per cent for different sizes of samples; and are on the whole in fairly satisfactory agreement. The co-efficient of variation "between Thanas", however, is still abnormally low in the case of samples of size 33 and 22 square feet; this indicates some lack of uniformity in the field data.

38. For the material as a whole, that is, by pooling together samples of different sizes, we find that the total co-efficient of of variation is 56.72 per cent; the variation "within Thanas" is 54.87 per cent; while the variation "between Thanas" is only 22.53 per cent. It is interesting to observe that the variation in mean yields between different villages within the same Thana is apparently higher than the variation between different Thanas.

39. In order to investigate this point in greater detail we have also considered the variations between sub-samples. It will be remembered that samples of size 66, 33 and 22 square feet were collected in 6, 3 and 2 samples each of 11 square feet taken at random within the same plot. These sub-samples make it possible to estimate "the variance within plots" for these three sizes of samples. The results are shown in Table (4.4), in which col. (1) shows the size (area) of samples; col. (2) the degree of freedom; col. (3) the mean yield (in tolas per 11 square feet); col. (4) the sum of squares; col. (5) the mean square; and col. (6) the co-efficient of variation. It will be noticed that the co-efficient of variation fluctuates from 27.88 to 36.05 per cent; and for the pooled material is about 36 per cent.

TABLE (4.4),  
Variation within Plots (in tolas per 11 sq. ft.)

Size of samples.	Degrees of Freedom	Mean yield	Sum of Squares	Mean Square	Co-efficient of Variation	Intra-class Correlation
(1)	(2)	(3)	(4)	(5)	(6)	(7)
66 sq. ft. ...	110	14.23	2605.0104	24.5910	34.85	+0.5616
33 sq. ft. ...	44	11.93	813.7800	18.4950	36.05	+0.5679
22 sq. ft. ...	21	11.89	230.7100	10.9900	27.88	+0.5828
Pooled ...	175	612.69	3649.5004	20.8543	35.98	

40. We find from the present material that the variation in mean yields within the same plot is of the order of 36 per cent; the variation between different villages or plots within the same Thana is appreciably higher and of the order of 50 per cent; while the variation between mean yields in different Thanas is apparently lower and of the order of 23 per cent.

41. From the results given in Table (4.4) for the "variance within plots" it is possible to calculate directly the value of the intra-class correlation between yields of adjoining plots. The values are given in the last column (7) of Table (4.4), and are + 0.56, + 0.57, + 0.58 respectively for samples of size 66, 33 and 22 square feet.

42. Although the material was meagre and was not entirely satisfactory from the statistical point of view, we have made an attempt to study the Variance Function or the relation between the standard deviation and the size (area) of samples. It will be remembered that in the case of the sample survey of the area under jute we had found that the results could be satisfactorily graduated with the help of a Variance Function of the form

$$Vx = C. (x)^{-g} \dots \dots \dots (3)$$

where  $Vx$  is the variance for samples of size  $x$  (area); and  $C$  and  $g$  are constants.

43. In using this Variance Function we have at our disposal three types of variance, namely, (1) the total variance, (2) the variance within Thanas as estimated by  $(s_1)^2$ ; and (3) the variance between Thanas as estimated by  $(s_2)^2$ . All three types were graduated, and the results are given in Table (4.5). It is interesting to observe that in every case 'g' is less than 1 showing the presence of correlation in the yield of jute in adjoining areas. This is of course directly corroborated by the results already obtained for intra-class correlations given above, and is just what is to be expected from physical considerations."

TABLE (4.5).

Graduated Values of 'g' and 'c'.

Type of Variance	'g'	'c'
(1)	(2)	(3)
Total ...	0.5069	22.10
Within Thanas ..	0.5254	20.58
Between Thanas ...	0.6436	1.78

44. The observed values of the variance are shown in Table (4.6) for comparison with the values calculated from the graduated expressions. In this Table col. (1) gives the size (area) of samples; columns (2), (4) and (6) the observed values of the variance; and columns (3), (5) and (7) the corresponding graduated values respectively.

TABLE (4.6)

Observed and Graduated Value of Variance.

Size of Sample	Total Variance		Within Variance		Between Variance	
	Observed	Graduated	Observed	Graduated	Observed	Graduated
(1)	(2)	(3)	(4)	(5)	(6)	(7)
5.5 sq. ft. ...	31.77	22.10	29.42	20.58	3.0071	1.7834
11 sq. ft. ...	12.50	15.55	10.66	14.30	2.3463	1.1415
22 sq. ft. ...	6.85	10.94	6.70	9.93	0.1947	0.7307
33 sq. ft. ...	8.96	8.91	8.88	8.03	0.1093	0.6529
66 sq. ft. ...	8.62	6.27	7.01	5.58	2.0095	0.3003

45. The graduation, which is based only on five different sizes of samples, cannot be called satisfactory; on the whole it is better for the "total variance" and variance "within Thanas", but is particularly bad in the case of variance "between Thanas". This is again another sign of heterogeneity already noticed. It must be remembered of course that the number of Thanas for which material is available is only six; and it is quite possible that a much larger number of Thanas requires to be studied before any kind of statistical uniformity can be reached.

### Section 5. NOTES ON TIME RECORDS

46. I have already mentioned that the time and cost records were kept for each Unit as a whole which made it quite impossible to study the cost function for different sizes (area) of samples or for different components such as journeys from one sample to another. Besides this there were a large number of serious gaps in the records; it is therefore not possible to make any reliable estimate regarding the cost of Investigators and Inspectors, charges for hiring the pond, compensation paid to the cultivators or total charges paid for hired labour etc.

47. The records for "full days" and "part days" were so incomplete that it was not possible to do anything with them. I have however collected in Table (5·1) certain entries for hours of work and days of steeping to get some tentative idea of time requirements at certain stages of the field work. In this Table (5·1) col. (1) gives the name of the thana; cols. (2), (4), (6), (8) and (10) the number of Units for which records are available; and cols. (3), (5), (7), (9) and (11) the total time required for selection of plots, cutting of jute and measurements, steeping, actual number of hours of drying of jute, and stripping and washing respectively in the case of each thana

TABLE (5.1).

## Time Requirements

Name of Thana	Selection of Plots		Cutting &c.		Steeping		Drying		Stripping	
	Units	Hours	Units	Hours	Units	Days	Units	Hours	Units	Hours
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Jamalpur	7	173	7	211	7	77	7	144	7	38
Kishoreganj	5	90	5	74	5	63	5	101	5	29
Gaibandha	3	81	3	69	3	34	3	37	2	14
Pabna Sadar	3	116	3	144	...	...	1	41	3	30
Barsat	1	30	1	12	1	12	1	15	...	...
Rungpur	3	226	2	71	...	...	19	17	3	17
TOTAL	22	716	21	581	16	186		355	20	128
Average	...	32.6	...	27.7	...	11.6	...	18.7	...	6.4

48. It will be noticed from the averages given at the bottom of the Table (5.1) that 32.6 hours or about four days (on the basis of 8 hours of work per day) were required for selecting the plots and securing the permission of the owners; 27.7 hours or roughly three days and a half for cutting the jute and taking preliminary measurements; 11.6 or about 12 days for steeping the jute plants; 18.7 hours or a little over 2 days for drying the fibre; and 6.4 hours or just under one day for the final stage of stripping the jute. Adding say one day for carrying the jute to the central camp, it will be seen that about 8 or 9 days were required before steeping, about 12 days for steeping of the plants, and about 3 or 4 days for drying and completing the final measurements.

49. I have also collected in Table (5.2) available records relating to the number of days of hired labour. In this table col. (1) gives the name of the thana, cols. (2), (4), (6) and (8) the number of Units for which records are available; and cols. (3), (5), (7) and (9) the number of days of hired labour required for cutting the jute plants, carrying to the central camp, steeping and for final stripping and washing respectively.

TABLE (5.2).  
Number of Days of Hired Labour

Name of Thana	Cutting		Carrying		Steeping		Stripping		
	Units	Days	Units	Days	Units	Days	Units	Days	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
Jamalpur ...	7	42	7	8	7	12	7	11	
Kishoreganj ...	5	35	...	...	5	4	5	8	
Gaibandha ...	3	19	3	1	3	2	3	3	
Pabna Sadar ...	3	20	3	3	3	4	3	5	
Barasat ...	1	2	...	...	1	2	1	2	
Rangpur ...	3	11	3	3	3	3	3	3	
<b>Total</b> ...	<b>22</b>	<b>129</b>	<b>16</b>	<b>15</b>	<b>22</b>	<b>27</b>	<b>22</b>	<b>204</b>	<b>Total</b>
<b>Average</b> ...		<b>5.86</b>		<b>0.94</b>		<b>1.23</b>		<b>1.91</b>	<b>9.94</b>

50. From the averages given at the bottom of Table (5.2) it will be seen that roughly 6 man-days were required for cutting the crop, one man-day for carrying, a little over one man-day for steeping, and about 2 man-days for stripping and washing; so

that altogether about 10 man-days of hired labour were required for the whole work.

## Section 6. SUMMARY OF CONCLUSIONS

51. I have already mentioned that the chief purpose of undertaking the crop-cutting experiments in 1939 was to study the technique of the field work. I am giving below a summary of conclusions with special reference to the planning of such surveys in future.

(1) It is clear from the work done in 1939 that the method of random samples can be used with success in carrying out crop-cutting experiments on jute.

(2) A large number of plots has to be examined, however, in order to select suitable fields in which the jute is in a proper condition for being cut and for which necessary permission can be secured from the owners.

(3) There are no special difficulties in locating the samples at random, cutting the jute, or in taking measurements on the green plants.

(4) It is, however, necessary to arrange the steeping being done in a central place where the jute can be properly guarded.

(5) To complete the work on 23 samples in each field unit it was found that it took about 4 days for preliminary selection of plots and for securing the owners' permission; about 4 days for cutting the jute, taking measurements on the green plants, and carrying them to the central camp; about 12 days for steeping; and 3 or 4 days for stripping, washing, drying, and taking measurements of the dry fibre. On an average it was necessary to engage hired labour for 10 man-days per field unit.

(6) The mean weight of green plants fluctuated from 125 to 303 maunds per acre for the "deshi" variety, and from 123 to 311 maunds per acre for "tosha" jute in the case of individual field units. The thana means varied from 163 to 233 maunds per acre for "deshi" and from 177 to 288 maunds per acre for the "tosha" variety.



(7) The number of plants per acre varied from 93 to 178 thousands for "deshi", and from 72 to 225 thousands for the "tosha" variety in individual field units. In the case of thanas the mean value varied from 49 to 127 thousands for "deshi", and from 104 to 179 for "tosha" jute.

(8) The mean yield of dry fibre fluctuated from 10 to 27 maunds per acre for the "deshi", and from 11 to 31 maunds per acre for the "tosha" variety in individual field units. The thana means varied from 15 to 22 maunds for "deshi" and from 14 to 26 maunds per acre for "tosha" jute.

(9) From a detailed analysis of variance it was found that the percentage variation in the mean yield of dry fibre was of the order of 36 per cent between sub-samples within plots; 50 per cent between villages within Thanas; and about 23 per cent between Thanas. The range of variation is, therefore, much less than that in the case of the proportion of land under jute. It should, therefore, be possible to attain with an appreciably smaller number of samples the same accuracy in estimates of the mean yield of jute as in the case of estimates of area.

(10) The co-efficient of correlation between the weight of dry fibre and the weight of green plants was found to be consistently high; and the average value was about 0.75 for the "deshi", 0.85 for the "tosha" variety, and 0.82 for the two combined. This result is of considerable practical importance as it may enable a method being developed for obtaining a preliminary estimate of the yield of dry fibre based on the weight of green plants.

(11) The co-efficient of correlation between the weight of dry fibre and the number of plants was only moderate, and 0.43 for the "deshi" variety and 0.53 for "tosha" jute; while the pooled value for both varieties combined was 0.49.

(12) The co-efficient of correlation between the weight of green plants and the number of plants was still smaller, and the average value was 0.37 for "deshi" and 0.35 for "tosha" jute, with a combined value of 0.33.

(13) Although measurements had been taken on height and girth of green plants and length of fibre it was not possible to make any use of them as the records were not in a form suitable

for statistical treatment. How far these or similar measurements can be of use in improving the estimates of yield of dry fibre deserves further study.

(14) A preliminary study of the variance function showed that the "g" constant was less than unity in every case indicating the presence of correlation between yields in adjoining plots. This was directly corroborated by a study of the co-efficient of intra-class correlation which was found to be of the order of + 0.56 for samples of size 66 square feet. This shows that, as in the case of the area survey, sample cuts of comparatively small size are likely to be more efficient than sample cuts of very large size. It is, therefore, necessary to study the variance function more thoroughly in future surveys.

(15) The best size and density of sample cuts will naturally depend on the cost function. Unfortunately the time and cost records were not kept in a suitable form to enable this question being studied in any way. The study of the cost function should therefore form a major objective in planning future surveys.

P. C. MAHALANOBIS.

DARJEELING

*13th July, 1940.*

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TABLE (1)

## List of Field Units

Serial No. of Unit.	Name of District & Police Station	Jurisdiction List Number	Name of Mouza
	<b>Mymensingh</b>		
1	Jamalpur	366	Koidola
2	"	314, 316, 317	Chassi, Narayanpur, Pinderhati
3	"	400, 412, 413	Ranagacha, Belbelia, Kanil,
		414	Gorarkanda
4	"	206	Bansibangali
5	"	169, 179	Bhatara, Fulbaria
11	"	80, 274, 275	Palashgarh, Phulbaria, Singhjani
15	"	301, 302, 347	Pingalhati, Bhela Pingalhati, Sitalkursa
	<b>Mymensingh</b>		
6	Kishoreganj	118, 120, 128	Chanddasa, Nandla, Nohar
7	"	77, 80, 81	Brahman Kachuri, Barabhadg, Dankia
8	"	114	Jasodal
27	"	99	Binnati
28	"	174	Mahinanda
	<b>Rangpur</b>		
9	Gaibandha	101, 102	Paschimkonarnai, Purbakonarnai
14	"	13, 22, 95	Narayanpur, Kholabari, Dhau- ghara
17	"	108	Uttargidari
	<b>Pabna</b>		
19	Pabna Sadar	61, 62, 63	Chak-Bhomra, Nazirpore, Chirat
22	"	98, 104, 105	Hamchapur, Radhanagar, Jotnarayan
23	"	149, 151	Jotgauri Jalalpur, Gayeshpore
	<b>24 Parganas</b>		
21	Barasat	205, 207	Kola, Tehatta
	<b>Rangpur</b>		
10	Rangpur Sadar	49, 50, 51, 60, 61	Dhap, Chabbishagari, Niamat, Kellabandha Bhagi
12	"	101, 126, 127, 128, 129, 132	Barabari, Darsanpahari, Kismat- bisu, silimpur, Nazirdigar, Shekhpara
13	"	57, 94, 95, 96, 98, 102	Pirzabad, Satgara, Goneshpur, Alamnagar, Binodepur, Deodoba.

TABLE (2·1)

Weight of Green Plants in mds. per acre : Deshi Jute (1939)

Field Unit No.	No. of Samples (n)	Mean value ± Standard Error.	Standard Deviation.	Co-efficient of Variation.
(1)	(2)	(3)	(4)	(5)
<b>MYMENSINGH : Thana--Jamalpur.</b>				
2	21	173·26 ± 15·65	71·71	41·39
3	8	303·26 ± 42·89	121·30	40·00
4	17	183·10 ± 18·69	77·03	42·07
5	23	205·30 ± 26·12	125·30	61·03
11	15	233·89 ± 18·88	73·16	31·28
15	16	249·63 ± 29·07	116·26	46·57
<b>Thana</b>	<b>100</b>	<b>214·03 ± 10·38</b>	<b>103·81</b>	<b>48·50</b>
<b>MYMENSINGH : Thana—Kishoreganj.</b>				
6	14	166·75 ± 11·09	41·48	24·87
7	10	134·36 ± 29·56	93·49	69·59
8	8	192·22 ± 33·55	94·90	49·37
27	9	125·01 ± 17·99	53·99	43·19
28	11	193·33 ± 49·49	164·13	84·89
<b>Thana</b>	<b>52</b>	<b>162·84 ± 13·85</b>	<b>96·29</b>	<b>59·13</b>
<b>RANGPUR : Thana—Gaibandha.</b>				
9	22	232·77 ± 24·22	113·60	48·80
14	22	259·99 ± 24·89	116·71	44·89
17	8	156·82 ± 39·39	111·42	71·05
<b>Thana</b>	<b>52</b>	<b>232·60 ± 16·16</b>	<b>116·55</b>	<b>50·11</b>
<b>RANGPUR : Thana—Rangpur Sadar (Variety not known)</b>				
10	23	187·74 ± 18·22	87·34	46·52
12	23	248·64 ± 24·68	118·34	47·60
13	23	119·44 ± 23·77	113·99	57·15
<b>Thana</b>	<b>69</b>	<b>211·93 ± 11·61</b>	<b>96·46</b>	<b>45·52</b>

TABLE (2·2)

Weight of Green Plants in mds. per acre : Tosha Jute (1939)

Field Unit No.	No. of Samples (n)	Mean Value ± Standard Error	Standard Deviation	Coefficient of Variation
(1)	(2)	(3)	(4)	(5)
<b>MYMENSINGH : Thana—Jamalpur.</b>				
1	23	227·97 ± 15·31	73·40	32·20
2	2	154·85 ± 58·31	82·47	53·26
3	15	184·97 ± 24·19	93·68	50·65
4	6	253·09 ± 43·20	105·81	41·81
11	8	198·52 ± 23·05	65·19	32·84
15	7	128·61 ± 33·76	89·31	69·44
<b>Thana</b>	<b>61</b>	<b>202·20 ± 11·11</b>	<b>86·80</b>	<b>42·93</b>
<b>MYMENSINGH : Thana—Kishoreganj.</b>				
6	9	122·77 ± 11·95	35·88	21·22
7	13	246·46 ± 20·06	72·34	29·35
8	15	151·52 ± 18·95	73·40	48·44
27	14	178·21 ± 24·55	91·88	51·56
28	12	174·80 ± 22·55	78·10	44·68
<b>Thana</b>	<b>63</b>	<b>177·37 ± 10·42</b>	<b>82·73</b>	<b>46·64</b>
<b>RANGPUR : Thana—Gaibandha.</b>				
9	1	306·90	...	...
14	1	204·19	...	...
17	15	291·95 ± 40·38	156·37	53·56
<b>Thana</b>	<b>17</b>	<b>287·67 ± 35·86</b>	<b>147·88</b>	<b>51·41</b>
<b>PABNA : Thana—Pabna Sadar.</b>				
19	23	310·91 ± 17·60	84·39	27·15
22	21	238·01 ± 9·92	45·48	19·11
23	20	226·13 ± 27·13	121·31	53·63
<b>Thana</b>	<b>64</b>	<b>260·54 ± 11·89</b>	<b>95·13</b>	<b>36·51</b>
<b>24-PARGANAS : Thana—Barasat.</b>				
21	12	262·10 ± 29·71	102·91	39·26

TABLE (2·3)

Number of Plants in thousands per acre : Deshi Jute (1939)

Field Unit No.	No. of Samples(n)	Mean Values ± Standard Error	Standard Deviation	Coefficient of Variation
(1)	(2)	(3)	(4)	(5)
<b>MYMENSINGH : Thana—Jamalpur</b>				
2	21	138·36 ± 14·85	68·03	49·17
3	8	145·29 ± 20·83	58·89	40·53
4	17	132·82 ± 13·98	57·70	43·44
5	23	146·28 ± 15·33	73·54	50·27
11	15	156·42 ± 13·90	53·90	34·46
15	16	177·76 ± 13·35	53·34	30·01
Thana	100	48·82 ± 6·26	62·73	42·15
<b>MYMENSINGH : Thana—Kishoreganj</b>				
6	14	117·02 ± 11·56	43·24	36·95
7	10	113·45 ± 18·97	60·00	52·88
8	8	135·47 ± 34·77	98·29	72·55
27	9	102·80 ± 14·06	42·13	40·99
28	11	127·31 ± 12·32	40·91	32·13
Thana	52	118·88 ± 7·80	56·15	47·24
<b>RANGPUR : Thana—Gaibandha</b>				
9	22	139·75 ± 9·74	45·74	32·73
14	22	125·65 ± 9·07	42·45	33·79
17	8	92·98 ± 6·42	18·10	19·46
Thana	52	126·56 ± 5·90	43·16	34·11
<b>RANGPUR : Thana—Rangpur Sadar (Variety not known)</b>				
10	23	99·20 ± 12·00	57·58	58·04
12	23	102·09 ± 8·75	42·06	41·19
13	23	107·43 ± 18·18	87·12	81·09
Thana	69	102·92 ± 7·68	63·68	61·87

TABLE (2.4)

Number of Plants in thousands per acre : Tosha Jute (1939)

Field Unit No.	No. of Samples(n)	Mean Values ± Standard Error	Standard Deviation	Coefficient of Variation
(1)	(2)	(3)	(4)	(5)
<b>MYMENSINGH : Thana—Jamalpur</b>				
1	23	212.69 ± 19.64	93.97	44.18
2	2	71.64 ± 37.94	53.66	74.90
3	15	158.12 ± 10.65	41.30	26.12
4	6	98.13 ± 13.11	32.08	31.42
11	8	224.80 ± 39.68	112.23	49.92
15	7	160.66 ± 57.86	153.05	95.27
Thana	61	179.39 ± 12.32	96.27	53.66
<b>MYMENSINGH : Thana—Kishoreganj</b>				
6	9	89.89 ± 11.29	33.86	37.67
7	13	124.50 ± 16.39	59.08	47.46
8	15	109.26 ± 17.34	67.12	61.44
27	14	117.97 ± 11.13	41.66	35.31
28	12	92.82 ± 10.41	36.12	38.91
Thana	63	108.42 ± 6.45	51.08	47.11
<b>RANGPUR : Thana—Gaibandha</b>				
9	1	158.40	...	...
14	1	93.06	...	...
17	15	143.39 ± 10.69	41.42	28.88
Thana	17	141.33 ± 9.90	40.83	28.89
<b>PABNA : Thana—Pabna Sadar</b>				
19	23	168.54 ± 12.79	61.26	36.35
22	21	145.69 ± 11.68	53.50	36.72
23	20	114.64 ± 11.33	50.65	44.18
Thana	64	144.18 ± 7.37	59.04	40.95
<b>24-PARGANAS : Thana—Barasat</b>				
21	12	103.99 ± 9.19	31.84	30.62

TABLE (2.5)

Weight of Dry Fibre in mds. per acre : Deshi Jute (1939)

Field Unit No.	No. of Samples (n)	Mean Value ± Standard Error	Standard Deviation	Coefficient of Variation
(1).	(2)	(3)	(4)	(5)
<b>MYMENSINGH : Thana — Jamalpur</b>				
2	21	22.55 ± 2.54	11.64	51.65
3	8	18.92 ± 2.93	8.29	43.82
4	17	23.25 ± 2.43	10.01	43.05
5	23	25.85 ± 2.65	12.70	49.11
11	15	17.63 ± 0.89	3.45	19.58
15	16	20.44 ± 2.20	8.81	43.10
<b>Thana</b>	<b>100</b>	<b>22.06 ± 1.04</b>	<b>10.38</b>	<b>47.06</b>
<b>MYMENSINGH : Thana — Kishoreganj</b>				
6	14	14.11 ± 0.90	3.38	23.95
7	10	9.74 ± 1.68	5.33	54.76
8	8	13.32 ± 2.34	6.61	49.63
27	9	16.87 ± 8.59	25.76	152.75
28	11	20.63 ± 5.80	19.27	93.40
<b>Thana</b>	<b>52</b>	<b>15.00 ± 1.98</b>	<b>14.29</b>	<b>95.30</b>
<b>RANGPUR : Thana — Gaibandha</b>				
9	22	15.05 ± 1.44	6.73	44.74
14	22	26.64 ± 2.55	11.94	44.82
17	8	16.45 ± 3.25	9.22	56.06
<b>Thana</b>	<b>52</b>	<b>20.17 ± 1.52</b>	<b>10.98</b>	<b>54.42</b>
<b>RANGPUR : Thana — Rangpur Sadar (Variety not known)</b>				
10	23	17.19 ± 1.94	9.29	54.07
12	23	15.90 ± 1.78	8.58	53.93
13	23	19.72 ± 2.40	11.51	58.34
<b>Thana</b>	<b>69</b>	<b>17.61 ± 1.18</b>	<b>9.78</b>	<b>55.52</b>



TABLE (2.6)  
Weight of Dry Fibre in mds. per acre : Tosha Jute (1939)

Field Unit No.	No. of Samples (n)	Mean Value $\pm$ Standard Error	Standard Deviation	Coefficient of Variation
(1)	(2)	(3)	(4)	(5)
<b>MYMENSINGH : Thana—Jamalpur</b>				
1	23	19.79 $\pm$ 1.30	6.21	31.39
2	2	12.99 $\pm$ 2.48	3.50	26.95
3	15	12.67 $\pm$ 1.62	6.26	49.41
4	6	31.38 $\pm$ 4.67	11.43	36.44
11	8	19.65 $\pm$ 3.42	9.68	49.24
15	7	13.93 $\pm$ 3.90	10.31	73.98
Thana	61	18.27 $\pm$ 1.18	9.16	50.14
<b>MYMENSINGH : Thana—Kishoreganj</b>				
6	9	13.69 $\pm$ 2.59	7.76	56.69
7	13	18.77 $\pm$ 1.89	6.81	36.26
8	15	11.22 $\pm$ 1.31	5.07	45.20
27	14	14.19 $\pm$ 2.62	9.80	69.05
28	12	15.85 $\pm$ 2.31	8.03	50.66
Thana	63	14.68 $\pm$ 0.98	7.81	53.20
<b>RANGPUR : Thana—Gaibandha</b>				
9	1	19.80		
14	1	17.33		
17	15	26.85 $\pm$ 3.24	12.57	46.82
Thana	17	25.88 $\pm$ 2.93	12.09	46.72
<b>PABNA : Thana—Pabna Sadar</b>				
19	23	17.21 $\pm$ 0.92	4.37	25.39
22	21	13.80 $\pm$ 0.56	2.52	18.30
23	20	14.24 $\pm$ 1.46	6.51	45.70
Thana	64	15.16 $\pm$ 0.61	4.89	32.44
<b>24 PARGANAS : Thana—Barasat</b>				
21	12	13.93 $\pm$ 1.26	4.37	31.32

TABLE (3.1)

Correlation between Weight of Dry Fibre in mds. per acre (y) and Weight of Green Plants in mds. per acre (x) : Deshi Jute (1939)

Serial No. of Unit.	No. of Samples (n)	Coefficient of Correlation	Regression Equation	
			"a"	"b"
(1)	(2)	(3)	(4)	(5)
<b>MYMENSINGH : Thana—Jamalpur</b>				
2	21	0.4946*	8.66	0.0803
3	8	0.8924**	0.44	0.0610
4	17	0.6628**	7.48	0.0862
5	23	0.6572**	12.22	0.0665
11	15	0.7569**	3.26	0.0614
15	16	0.9087**	3.24	0.0688
Thana	100	0.5428**	10.40	0.0545
<b>MYMENSINGH : Thana—Kishoreganj</b>				
6	14	-0.0663	15.01	-0.0054
7	10	0.7299**	4.17	0.0416
8	8	0.9814**	0.23	0.0682
27	9	0.4721	-11.28	0.2252
28	11	0.9561**	-1.02	0.1122
Thana	52	0.6469**	-0.65	0.0960
<b>RANGPUR : Thana—Gaibandha</b>				
9	22	0.8226**	3.70	0.0487
14	22	0.6238**	10.05	0.0638
17	8	0.9671**	3.87	0.0801
Thana	52	0.6767**	5.47	0.0631
<b>RANGPUR : Thana—Rangpur Sadar (Variety not known)</b>				
10	23	0.7703**	1.08	0.0857
12	23	0.1197	13.63	0.0091
13	23	0.7163**	4.68	0.0756
Thana	69	0.5686**	5.40	0.0576

TABLE (3·2)

Correlation between Weight of Dry Fibre in mds. per acre (y) and Weight of Green Plants in mds. per acre (x) : Tosha Jute (1939)

Serial No. of Unit.	No. of Samples (n)	Coefficient of Correlation.	Regression Equation.	
			"a"	"b"
(1)	(2)	(3)	(4)	(5)
<b>MYMENSINGH : Thana—Jamalpur.</b>				
1	23	0·5014*	10·12	0·0424
3	15	0·9452**	0·98	0·0632
4	6	0·8242*	8·84	0·0891
11	8	0·6145	1·50	0·0912
15	7	0·9402**	-0·08	0·1086
Thana	61	0·7271**	2·78	0·0767
<b>MYMENSINGH : Thana—Kishoreganj.</b>				
6	9	-0·4948	26·84	-0·1069
7	13	0·6595**	3·52	0·0620
8	15	0·5274*	5·67	0·0365
27	14	0·8172**	-1·31	0·0871
28	12	0·8455**	0·63	0·0870
Thana	63	0·6639**	3·58	0·0627
<b>RANGPUR : Thana—Gaibandha.</b>				
17	15	0·9329**	4·95	0·0750
Thana	17	0·9210**	4·19	0·0753
<b>PABNA : Thana—Pabna Sadar.</b>				
19	23	0·9179**	2·44	0·0475
22	21	0·8895**	2·07	0·0493
23	20	0·9744**	2·44	0·0522
Thana	64	0·9479**	2·48	0·0486
<b>24 PARGANAS : Thana—Barasat.</b>				
24	12	0·7898**	5·15	0·0335

TABLE (3·3)

Correlation between Weight of Dry Fibre in mds. per acre (y) and Number of Plants in thousands per acre (x): Deshi Jute (1939)

Serial No. of Unit	No. of Samples (n)	Coefficient of Correlation	Regression Equation	
			"a"	"b"
(1)	(2)	(3)	(4)	(5)
<b>MYMENSINGH : Thana—Jamalpur</b>				
2	21	0·3002	15·46	0·0514
3	8	0·7418*	3·78	0·1044
4	17	0·3415	15·36	0·0593
5	23	0·6039**	10·64	0·1042
11	15	0·4127	10·55	0·0454
15	16	0·4162	8·21	0·0687
Thana	100	0·4000**	12·20	0·0662
<b>MYMENSINGH : Thana—Kishoreganj</b>				
6	14	0·3456	10·95	0·0270
7	10	0·7998**	1·77	0·0705
8	8	0·6650	7·30	0·0446
27	9	0·5730	-19·23	0·3505
28	11	-0·2670	36·94	-0·1284
Thana	52	0·2301	8·01	0·0587
<b>RANGPUR : Thana—Gaibandha</b>				
9	22	0·4558*	5·67	0·0670
14	22	-0·0173	27·30	-0·0052
17	8	0·5078	-7·64	0·2590
Thana	52	0·1131	16·86	0·0284
<b>RANGPUR : Thana—Rangpur Sadar (Variety not known)</b>				
10	23	0·4060	10·44	0·0682
12	23	0·3308	8·67	0·0709
13	23	0·3900	13·94	0·0540
Thana	69	0·3971**	11·33	0·0610

TABLE (3.4)

Correlation between Weight of Dry Fibre in mds. per acre (y) and Number of Plants in thousands per acre (x) : Tosha Jute (1939)

Serial No. of Unit	No. of samples (n)	Coefficient of Correlation	Regression Equation	
			"a"	"b"
(1)	(2)	(3)	(4)	(5)
<b>MYMENSINGH : Thana—Jamalpur</b>				
1	23	0.2514	16.26	0.0166
3	15	0.0224	12.12	0.0035
4	6	0.1603	25.77	0.0572
11	8	0.6795	6.47	0.0586
15	7	0.8980**	4.19	0.0605
Thana	61	0.3123*	12.95	0.0297
<b>MYMENSINGH : Thana—Kishoreganj</b>				
6	9	0.5833	1.68	0.1335
7	13	-0.1371	20.73	-0.0158
8	15	0.8126**	4.52	0.0615
27	14	0.3056	5.71	0.0719
28	12	0.2960	9.73	0.0658
Thana	63	0.3150*	9.47	0.0482
<b>RANGPUR : Thana—Gaibandha</b>				
17	15	0.4935	5.43	0.1498
Thana	17	0.4921*	5.35	0.1456
<b>PABNA : Thana—Pabna Sadar</b>				
19	23	0.8086**	7.46	0.0577
22	21	0.3562	11.35	0.0168
23	20	0.7067**	3.81	0.0907
Thana	64	0.6532**	7.38	0.0540
<b>24 PARGANAS : Thana—Barasat</b>				
21	12	0.5232	6.48	0.0716

TABLE (3·5)

Correlation between Weight of Green Plants in mds. per acre (y) and Number of Plants in thousands per acre (x) : Deshi Jute (1939)

Serial No. of Unit	No. of Samples (n)	Coefficient of Correlation	Regression Equation	
			'a'	'b'
(1)	(2)	(3)	(4)	(5)
<b>MYMENSINGH : Thana—Jamalpur</b>				
2	21	0·6586	77·47	·6941
3	8	0·5100	150·89	1·0508
4	17	0·0448	175·24	·0591
5	23	0·4989*	81·19	·8501
11	15	0·0200	229·57	·0277
14	16	0·2904	136·96	·6330
Thana	100	0·3974	116·54	·6543
<b>MYMENSINGH : Thana—Kishoreganj</b>				
6	14	-·1130	179·50	-·1090
7	10	·7985*	-6·27	1·2445
8	8	·5567	119·66	·5375
27	9	·5641	50·53	·7231
28	11	·0100	200·47	·0562
Thana	52	·3563**	90·17	·6107
<b>RANGPUR : Thana—Gaibandha</b>				
9	22	·4258*	84·68	1·0578
14	22	·1732	200·04	·4758
17	8	·4357	-92·80	2·6841
Thana	52	·3456*	114·16	·9326
<b>RANGPUR : Thana—Rangpur Sadar (Variety not known)</b>				
10	23	·1118	170·18	·1774
12	23	·3158	153·90	·9288
13	23	·4642*	131·52	·6348
Thana	69	·3660**	154·77	·5550

TABLE ( 3·6 )

Correlation between Weight of Green Plants in mds. per acre (y) and Number of Plants in thousands per acre (x): Tosha Jute (1939)

Serial No. of Unit	No. of Samples (n)	Coefficient of Correlation	Regression Equation	
			'a'	'b'
(1)	(2)	(3)	(4)	(5)
<b>MYMENSINGH : Thana—Jamalpur.</b>				
1	23	0·0265	223·54	0·0208
3	15	-0·0200	191·78	-0·0431
4	6	0·5409	78·21	1·7845
11	8	0·0224	195·48	0·0135
15	7	0·9665**	37·82	0·5639
Thana	61	0·2305	165·00	0·2078
<b>MYMENSINGH : Thana—Kishoreganj.</b>				
6	9	0·4397	80·85	0·4658
7	13	0·1929	217·13	0·2362
8	15	-0·0721	160·15	-0·0792
27	14	0·3784	79·73	0·8346
28	12	0·2105	132·50	0·4548
Thana	63	0·2214	138·64	0·3586
<b>RANGPUR : Thana—Gaibandha.</b>				
17	15	0·3809	86·32	1·4380
Thana	17	0·3979	84·57	1·4404
<b>PABNA : Thana—Pabna Sadar.</b>				
19	23	0·6374**	162·49	0·8782
22	21	0·0170	216·58	0·1468
23	20	0·7556**	29·48	1·7115
Thana	64	0·6018**	120·95	0·9694
<b>24-PARGANAS : Thana—Barasat.</b>				
21	12	0·2880	165·29	0·9309

TABLE (3·7)

Summary Table of Correlation between Weight of Dry Fibre  
in mds. per acre (y) and Weight of Green Plants  
in mds. per acre (x) : 1939.

Name of Thana	No. of Samples (n)	No. of Units	Degrees of Freedom	Average "z"	Coefficient of Correlation
(1)	(2)	(3)	(4)	(5)	(6)
Deshi Jute					
Jamalpur ...	100	6	82	0·92	0·7259
Kishoreganj ...	52	5	37	0·96	0·7443
Gaibandha ...	52	3	43	1·07	0·7895
All Thanas ...	204	14	162	0·97	0·7487
Tosha Jute					
Jamalpur ...	61	5	44	1·06	0·7857
Kishoreganj ...	63	5	48	0·88	0·7064
Gaibandha ...	17	1	12	1·68	0·9329
Pabna Sadar ...	64	3	55	1·71	0·9366
Barasat ...	12	1	9	1·07	0·7895
All Thanas ...	217	15	168	1·26	0·8511
Deshi and Tosha Jute Combined					
All Thanas ...	421	29	330	1·17	0·8243
Rangpur Sadar (Variety not known)					
Thana Sadar ...	69	3	60	0·68	0·5915
Grand Total ...	490	32	390	1·05	0·7818



TABLE (3-8)

Summary Table of Correlation between Weight of Dry  
Fibre in mds. per acre (y) and Number of  
Plants in thousands per acre (x) : 1939.

Name of Thana	No. of Samples (n)	No. of Units	Degress of Freedom	Average "z"	Coefficient of Correlation
(1)	(2)	(3)	(4)	(5)	(6)
<b>Desi Jute</b>					
Jamalpur ...	100	6	82	0.49	0.4542
Kishoreganj ...	52	5	37	0.59	0.5299
Gaibandha ...	52	3	43	0.29	0.2821
All Thanas ...	204	14	162	0.46	0.4301
<b>Tosha Jute</b>					
Jamalpur ...	61	5	44	0.36	0.3452
Kishoreganj ...	63	5	48	0.52	0.4777
Gaibandha ...	17	1	12	0.54	0.4930
Pabna ...	64	3	55	0.85	0.6911
Barasat ...	12	1	9	0.58	0.5227
All Thanas ...	217	15	168	0.59	0.5299
<b>Desi and Tosha Jute Combined</b>					
All Thanas ...	421	29	330	0.53	0.4854
<b>Rangpur Sadar (Variety not known)</b>					
Thana Sadar ...	69	3	60	0.39	0.3800
Grand Total ...	490	32	390	0.51	0.4699

TABLE (3·9)

Summary Table of Correlation between Weight of Green Plants in mds. per acre (y) and Number of Plants in thousands per acre (x) : 1939.

Name of Thana	No. of Samples (n)	No. of Units	Degrees of Freedom	Average 'z'	Coefficient of Correlation
(1)	(2)	(3)	(4)	(5)	(6)
<b>Desi Jute</b>					
Jamalpur ...	100	6	82	0·40	0·3800
Kishoreganj ...	52	5	37	0·43	0·4053
Gaibandha ...	52	3	43	0·33	0·3185
All Thanas ...	204	14	162	0·38	0·3714
<b>Tosha Jute</b>					
Jamalpur ...	61	5	44	0·25	0·2449
Kishoreganj ...	63	5	48	0·23	0·2260
Gaibandha ...	17	1	12	0·40	0·3800
Pabna Sadar ...	64	3	55	0·59	0·5299
Barasat ...	12	1	9	0·30	0·2913
All Thanas ...	217	15	168	0·37	0·3540
<b>Desi and Tosha Jute Combined</b>					
All Thanas ...	421	29	330	0·34	0·3275
<b>RANGPUR Sadar (Variety not known)</b>					
Thana Sadar ...	69	3	60	0·31	0·3004
Grand Total ...	490	32	390	0·37	0·3540

TABLE (4·2)  
Analysis of Variance : Weight of Dry Fibre (1939)

Source of Variation.	Degrees of Freedom.	Sum of Squares	Mean Square	Ratio of Variances
(1)	(2)	(3)	(4)	(5)
Size of Samples = 66 sq. feet.				
Between Thanas ...	5	20119·72	4023·95	3·987*
Within Thanas ...	60	60558·71	1009·31	
Total ...	65	80678·43	1241·21	
Size of Samples = 33 sq. feet.				
Between Thanas ...	5	1866·87	373·37	1·168
Within Thanas ...	81	25888·78	319·61	
Total ...	86	27755·65	322·74	
Size of Samples = 22 sq. feet.				
Between Thanas ...	5	744·95	148·99	1·391
Within Thanas ...	80	8570·83	107·14	
Total ...	85	9315·78	109·60	
Size of Samples = 11 sq. feet.				
Between Thanas ...	5	1138·72	227·74	5·341*
Within Thanas ...	121	5158·89	42·64	
Total ...	126	6297·61	49·98	
Size of Samples = 5·5 sq. feet.				
Between Thanas ...	5	440·77	88·15	2·996*
Within Thanas ...	120	3530·23	29·42	
Total ...	125	3971·80	31·77	
All Sizes of Samples (reduced to 11 sq. feet).				
Between Thanas ...	5	1504·29	300·86	4·643*
Within Thanas ...	486	31493·83	64·80	
Total ...	491	33998·12	69·24	

**APPENDIX II.**

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NOTE BY THE SECRETARY DATED THE 17TH JULY, 1940, ON SUBJECT NO. 3.—*To consider a Scheme for conducting crop-estimating survey for Jute in 1940.*

At its last meeting held on the 3rd April, 1940, the Jute Census Committee discussed the question of undertaking experimental crop-cutting work for the determination of the average yield of Jute per acre, and decided that Mr. Carbery and Prof. Mahalanobis should prepare a scheme as soon as possible for the consideration of the Committee.

2. Soon after his assumption of office, the present Secretary addressed both Mr. Carbery and Prof. P. C. Mahalanobis in the matter, and requested them to prepare a scheme, as desired by the Jute Census Committee, at a very early date. In his letter No. 26/40, dated the 13th May, 1940, the latter replied that the scheme had to be prepared in co-operation with the Director of Agriculture, Bengal, and enquired if any useful purpose would be served by undertaking any crop-cutting experiments in the current year in view of the lack of any budgetary provision for this purpose and the unlikelihood of any savings being made out of the allotment for the work on area-survey. The Secretary suggested that in view of the very great importance of the work, it was very desirable to proceed with the preparation of the crop-cutting scheme, and, if necessary, to divert to this work, with the approval of the Jute Census Committee, a portion of the allotment sanctioned for the area-survey, even though it meant leaving out a portion of the area that had to be surveyed from the Census Scheme. Accordingly, Prof. Mahalanobis has forwarded the attached scheme for the consideration of the Committee (Enclosure). It was prepared in consultation with Mr. Carbery. According to the scheme, it is proposed to undertake the work in four thanas this year and this preliminary experiment will, it is expected, enable a scheme to be prepared for an exploratory survey on a larger scale in 1941. The work is now being planned, no doubt, on a small scale but this is the best that can be done this season, considering that the time for making the necessary preparations for the experiment is very short and funds available for the work are not sufficient.

3. The estimated cost of the experiments, which will take about a month to be completed, is Rs. 2,800 as shown in paragraph 10 of Prof. Mahalanobis's note. It is proposed to find this amount from the savings out of the current year's budget of the Sampling Census of Jute. It may be noted that some expenditure will also have to be incurred for the statistical analysis of the data collected, and sanction for this will be asked for later in the year.

4. The Supervisor, Jute Census Scheme, will remain in charge of the field work in connection with this experiment. As the area-survey will have been completed by the time the crop-cutting work is taken in hand, he should have no difficulty in supervising the field operations connected with it.

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**ENCLOSURE**

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*Scheme for Crop-estimating Survey: Jute, 1940.*

1. Each Field Unit will consist of 6 Investigators under one Inspector; and four such Units will work in 4 Thanas in four important jute districts, namely, Chandpur in Comilla, Narsingdi in Dacca, Jamalpur in Mymensingh and Gaibandha in Rangpur.

2. In each Thana three circles of varying size will be selected and one pair of Investigators will be placed in charge of each circle. The Investigators will work in pairs and each pair, with the help of 2 labourers, will collect about 12 samples comprising 8 sub-cuts of different sizes varying from  $2' \times 2'$  (4 square feet) to  $33' \times 33'$  (1/40 acre).

3. The permission of the owner or the farmer will be secured before any jute is cut; and it is proposed to pay compensation at the rate of Rs. 4 per sample unit of about 1/40 acre, that is, at the rate of say Rs. 160 per acre or Rs. 10 per maund. It is proposed to dispose off the jute and credit the amount to our funds.

4. The sample-units will be located at random with the help of maps and random numbers supplied from the Statistical Laboratory for this purpose. As many of the plots may not be available for one reason or another, it is proposed to supply more than four times the required number to ensure at least one plot being selected at random in each locality.

5. Detailed *instructions* for the field work and necessary forms and appliances (such as tape, stick, etc.) will be supplied to each team.

6. After the jute is cut the number of plants in each sub-cut will be counted as also the girth and height of a number of plants selected at random; and the green weights of sub-cuts will be recorded.

7. The jute will then be carried to a central camp in each circle and arrangements will be made for retting, washing, stripping, and drying of the fibre under direct supervision of the field staff. The dry weight of the fibre will be then recorded.

8. Arrangements will be made for keeping a detailed record of the time required at each stage of the work in order to enable a preliminary study being made of the cost function. It is also proposed to study, in a tentative way, the variance function on the basis of the records for sub-cuts of different sizes. It is hoped that the preliminary work done this year will enable a scheme being prepared for an exploratory survey on a larger scale in 1941.

### *Budget*

9. One of the two Investigators working together will be called the senior Investigator and will be paid at the rate of Rs. 45 (pay Rs. 35 and F. T. A. Rs. 10) per month; his main duty will be to negotiate with the owners, locate the samples in the proper way and take measurements. The other Investigator, who will be called the junior Investigator, will be paid at the rate of Rs. 40 (pay Rs. 30 and F. T. A. Rs. 10) per month; his main duty will be to cut the jute with the help of the labourers and watch the retting, stripping, etc. The Inspector will inspect the work of the 3 teams and send weekly reports to the Head Office about the progress of work. After the work is finished the investigators will be discharged then and there and the Inspector will come to Calcutta to hand over charge.

10. It is expected that the actual work will take about a month. On this basis the expenditure for the field work will be as follows:—

		Rs.	As.	P.	Rs.	As.	P.
Pay of 6 Investigators	...	255	0	0			
Pay of 1 Inspector	...	65	0	0			
T. A. of the above workers for going to the place of work	...	75	0	0			
Compensation to be paid to the owner of the land @ Rs. 4/- per sample cut	... ..	144	0	0			
Pay of 6 labourers @ Rs. 20/- each	...	120	0	0			
		<u>659</u>	<u>0</u>	<u>0</u>			
4 Field units	...				2,636	0	0
Contingencies	...				264	0	0
					<u>TOTAL</u>	<u>...</u>	<u>2,900 0 0</u>
Less price of jute obtained	...				...	100	0 0
						<u>2,800</u>	<u>0 0</u>

11. The above estimate is necessarily of a very tentative nature and may require substantial modifications in the light of the actual experience gained on the field.

P. C. MAHALANOBIS.

6th July, 1940.



### APPENDIX III

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NOTE BY THE SECRETARY DATED THE 17TH JULY, 1940, ON SUBJECT NO. 4.—*To consider the revised budget of the Field work of the Sampling Census of Jute, 1940.*

The Jute Census Committee, at its meeting held on the 7th March, 1940, passed the budget estimate for the Scheme for the Improvement of Jute Forecast, 1940, at Rs. 1,30,000. This amount was allocated as below :—

		Rs.	As.	P.
(1) Field Work	...	78,000	0	0
(2) Statistical Work	...	52,000	0	0
TOTAL		1,30,000	0	0

The Jute Census Committee also provided a further sum of Rs. 30,000 to be kept in reserve for preliminary work for 1941 survey to be done between the period—October, 1940, and March, 1941. Thus the total budget for the Scheme for the Improvement of Jute Forecast, Bengal, 1940, comes to Rs. 1,60,000.

2. The amount is obtainable in the following way :—

		Rs.	As.	P.
(1) Amount available from the preliminary work for 1940 Survey done between the period October, 1939, and March, 1940, in 1939—40 budget. ...	... ..	21,000	0	0
(2) Amount provided by the Indian Central Jute Committee in its budget for 1940-41		62,500	0	0
(3) Amount contributed by the Government of Bengal during 1940-41 ...	... ..	62,500	0	0
(4) Amount to be obtained by transfer from the Committee's District Agricultural staff budget for 1940—41 (money value of the whole staff that will be employed for Jute Census work for 4½ months) ..	... ..	14,000	0	0
		1,60,000	0	0

3. The budget estimates of the Field work in connection with the Scheme for the Improvement of Jute Forecast, 1940, as now revised (*vide* statement enclosed) stands at Rs. 69,250 as against Rs. 78,000. A saving of Rs. 8,350 is thus expected to accrue.

4. Out of this amount, Prof. Mahalanobis proposes that the expenditure under the following heads should be sanctioned:—

	Rs.	As.	P.
(a) To pay the arrear contribution to the Statistical Institute (From July to December, 1938 ... ..)	1,200	0	0
(b) To meet the excess expenditure incurred by Prof. Mahalanobis in connection with the Statistical work for 1939 scheme ...	1,366	12	6
(c) To meet the excess expenditure on statistical side on account of delays in supply of maps, etc. during the stage of preparing sample grids this year ... ..	1,500	0	0
(d) Crop-cutting experiments 1939 (Statistical analysis) ... ..	1,440	0	0
(e) Excess expenditure for map mounting ...	715	4	9
(f) Proposed expenditure for crop-cutting experiments (field work) ... ..	2,800	0	0
Total Rs. ...	9,022	1	3

5. The above proposals are dealt with seriatim:—

- (a) At its meeting held in July, 1938, the Jute Census Committee recommended that, subject to the sanction of the Government of Bengal, Prof. Mahalanobis should be paid an allowance of Rs. 500 p. m. for doing statistical portion of the work in connection with the Scheme for the Improvement of Jute Forecast, Bengal, 1938. The Government of Bengal was addressed in the matter and they sanctioned the payment of a fee of Rs. 300 p. m. only. Prof. Mahalanobis did statistical work in connection with the Jute Census Scheme for 6 months from July to December, 1938, and was paid Rs. 1,800. Subsequently he proposed that the balance of the

grant @ Rs. 200 p. m. for 6 months—July to December, 1938, amounting to Rs. 1,200 only should be made over to the Indian Statistical Institute. The matter was placed before the Local Sub-Committee at its meeting held on the 18th September, 1939. It agreed that the additional grant of Rs. 1,200 should be made to the Indian Statistical Institute in recognition of the work done there from July to December, 1938. For want of funds this amount could not be paid during 1939-40. As the Local Sub-Committee has already approved of this additional grant, it may now be paid to the Indian Statistical Institute out of the expected savings of Rs. 8,350.

- (b) The Indian Central Jute Committee at its meeting held on the 8th February, 1939, sanctioned a block grant of Rs. 35,000 to be paid to the Indian Statistical Institute for statistical work in connection with the Scheme for the Improvement of Jute Forecast, Bengal, 1939. The entire amount was paid to Prof. Mahalanobis. In his letter dated the 28th February, 1940, Prof. Mahalanobis pointed out that the actual expenditure incurred by him for statistical work in connection with the 1939 Scheme was Rs. 36,366-12-6, *i.e.*, he had incurred an expenditure of Rs. 1,366-12-6 in excess of the block grant made to the Statistical Institute. He now states that as the Indian Statistical Institute is required to refund any unspent balance out of the grant made to it by the Indian Central Jute Committee, it would not be unreasonable to expect that the unavoidable excess expenditure incurred by it should be made good by reappropriation from the present expected saving of Rs. 8,350. In the circumstances stated, the amount may be sanctioned.
- (c) Prof. Mahalanobis points out that he had to incur an additional expenditure of Rs. 1,500/- from the Statistical Laboratory on account of delays and irregularities in the supply of mauza maps, Jurisdiction Lists, etc. during the stage of preparing the sampling units this year. The total additional staff which was used by him for this purpose was about

25 man-months, at an average rate of Rs. 60 per man-month. In the current year's plan of work for collection of maps, the Secretary has suggested *vide* Subject No. 8—the employment of Investigators on a pay of Rs. 25 a month. At this rate Prof. Mahalanobis's claim, if admitted, would amount to Rs. 625 only. But in view of the fact that this expenditure is essentially of the nature of a book transaction, and that the Committee is being asked to sanction the extra expenditure incurred by the Professor on the Statistical work in connection with the Scheme for 1939-40, it seems that it may, in its turn, reasonably ask for a *quid pro quo* and request the Professor to forego his claim under this head.

- (d) This item has been discussed under Subject No. 2 of the Agenda.
- (e) In the sanctioned allotment of Rs. 52,000 for the Statistical work in connection with the Scheme for Improvement of Jute Forecast, 1940, a sum of Rs. 16,000 was provided for purchase of maps. Out of this, Rs. 12,000 was set aside for purchase of maps and Rs. 4,000 for mounting of the maps on linen. The mounting work was done by the Statistical Laboratory and it incurred an actual expenditure of Rs. 4,715-4-9 as against Rs. 4,000. The excess expenditure has been already incurred. The Committee may accord its formal sanction to this amount.
- (f) This item has been discussed under Subject No. 3 of the Agenda. It is proposed to undertake the work, the cost of which will be met from the expected saving of Rs. 8,350.

6. If the proposals contained in the above paragraph are accepted, an aggregate sum of Rs. 7,522-1-3 only will be required to meet the various claims of the Professor under the different heads, and if, as is suggested, this amount is paid out of the anticipated savings of Rs. 8,350, the balance of Rs. 827-14-9 only may be set apart for meeting, in part or whole, the probable cost of the statistical analysis of the data collected from the proposed crop-cutting experiments of this year.

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**ENCLOSURE**

*Revised budget estimates of the Field Branch—Jute Census Scheme, 1940.*

DETAILS.	Budget estimates (as passed by the Jute Census Committee at its meeting held in March, 1940, and approved by the Committee in March, 1940.	Revised Estimates.	Increase + Decrease -	REMARKS.
<p align="center"><b>I. PAY OF ESTABLISHMENT.</b></p> <p align="center"><i>A—Field Staff.</i></p>				
(a) 1 Supervisor @ Rs. 400 P.M. for 5 months.	2,000	2,450(a)	+ 450	(a) @ Rs. 350 P.M. for 7 months.
(b) 1 Assistant Supervisor @ Rs. 180 P.M. for 7 months.	...	1,260(b)	+ 1,260	(b) Sanctioned by the Local Sub-Committee.
(c) (i) 4 Chief Inspectors for 4½ months @ Rs. 155 P.M.	2,790	3,350(c)	- 3,220	(c) 1 for 4 mos. @ Rs. 155 P.M.
(ii) 6 Chief Inspectors for 4½ months @ Rs. 140 P.M.	3,780			1 " 5 " " 140 "
				1 " 4 " " 140 "
				3 " 3½ " " 140 "

(d) 4 Check Inspectors for 3 months—2 @ Rs. 125 P.M. and 2 @ Rs. 65 P.M.

(e) 45 Inspectors @ 65 P.M. for 4 months.

(f) 270 Investigators @ Rs. 35 P.M. for 3½ months.

(g) 10 Peons @ Rs. 20 P.M. for 4½ months.

(h) 45 Peons @ Rs. 20 P.M. for 4 months.

...	1,140	+ 1,140		
11,700	6,761(e)	- 4,939		(e) 7 for 2½ mos. @ Rs. 65 P.M. 21 " 3 " " " 65 " 5 " 3½ " " " 65 " 1 " 6 " " " 65 "
33,075	26,055(f)	- 7,020		(f) 174 for 3 mos. @ Rs. 35 P.M. 58 " 1½ " " " 38 " 32 " 1½ " " " 40 " 6 " 6 " " " 35 "
900	2,900(g)	- 1,600		(g) Pay of 46 Peons.
3,600				
57,845	43,916	- 13,929		

ENCLOSURE—Contd.

DETAILS.	Budget estimates (as passed by the Jute Census Committee at its meeting held in March 1940 and approved by the Committee in March 1940.)	Revised Estimates.	Increase + Decrease -	REMARKS.	
<p style="text-align: center;"><i>B—Head Office Staff.</i></p> <p>(1) 1 Accountant and Cashier @ Rs. 100 P.M. for 6 months.</p> <p>(2) 1 Head Clerk @ Rs. 50 P.M. for 7 months.</p> <p>(3) 3 Clerks @ Rs. 50 P.M. for 6 months.</p> <p>(4) 3 typists @ Rs. 45 P.M. for 6 months.</p> <p>(5) 2 peons @ Rs. 15 P.M. for 6 months.</p> <p>(6) Special pay to the Senior Assistant in the Secretary's office @ Rs. 25 P.M.</p>	600	700(h)	+ 100	(h) for 7 months @ Rs. 100 P.M.	
	...	350	350	+ 350	
		900	720(i)	- 180	(i) for 6 months @ Rs. 40 P.M.
		810	420(j)	- 390	(j) 2 typists @ Rs. 35 P.M. for 6 months.
		180	195(k)	+ 15	(k) 1 for 6 months and the other for 7 months @ Rs. 15 P.M.
		300	300(l)	...	(l) Accounts Clerk for 6 months @ Rs. 50 P.M.
	2,790	2,685	- 105		

II. ALLOWANCES.

- (1) T. A. for Supervisor and posting of staff, etc.
- (2) (a) Railway Fare to 10 Chief Inspectors @ Rs. 50 P.M. each for 4 months.
- (b) Railway fare to 45 Inspectors @ Rs. 11 P.M. each for 4 months.

2,000	2,250	1,980	6,000(a)	-	230	700
			(a) T. A. for Supervisor for Assistant Supervisor for 6 Chief Inspectors for 4 Check Inspectors for 34 Inspectors and Orderlies Joining T. A. for Agricultural staff			
			6,000	-	230	700
			6,230			

6,000

III. CONTINGENCIES.

Printing	...	400	1,000	+	600
Office rent, fans and lights	...	500	750	+	250
Furniture hire	...	200	200		...
Telephone	...	100	100		...
Carried over	...	1,200	2,050	+	850



DETAILS.	Budget estimates (as passed by the Jute Census Committee at its meeting held in March 1940 and approved by the Committee in March 1240.)	Revised Estimates.	Increase + Decrease -	REMARKS
III. CONTINGENCIES—Contd.				
Brought forward ...	1,200	2,050	+ 850	
Transfer of cadastral maps ...	...	500	+ 500	
Purchase of extra thanas, district, etc., maps	...	600	+ 600	
Miscellaneous—Postage, Station- ery, etc.	800	2,500	+ 1,700	
	2,000	5,650	+ 3,650	
IV. PENSION AND LEAVE SALARY CONTRIBUTION OF THE SUPERVISOR.				
	...	400	+ 400	
	...	400	+ 400	

## V. AREA EXTRACTION WORK.

- (1) 16 Calculators @ Rs. 60 P.M. each for 3 months.  
 (2) 4 Checkers @ Rs. 60 P.M. for 3 months.  
 (3) Instrument and Miscellaneous

(b) Lump sum.

(c) Actual expenditure.

2,400			
720			
150			
<b>3,270</b>	<b>4,000(b)</b>	<b>+</b>	<b>730</b>
<b>6,000</b>	<b>7,000(c)</b>	<b>+</b>	<b>1,000</b>
78,135	69,651	-	8,484
78,000	69,650	-	8,350
Say ...			

## VI. EXPENDITURE INCURRED ON PREPARATORY FIELD WORK.

## SUMMARY.

	Rs.
1. (a) Pay of Establishment (Field staff)	43,916
(b) Do. (Head Office)	2,685
2. Allowance	6,000
3. Contingencies	5,650
4. Leave salary and pension contribution of the Supervisor	400
5. Area Extraction work	4,000
6. Expenditure incurred in preparatory Field work	7,000
<b>TOTAL Rs.</b>	<b>69,651</b>

## APPENDIX IV

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NOTE BY THE SECRETARY DATED THE 17TH JULY, 1940, ON SUBJECT NO. 5.—*To consider the preliminary progress report on the field work during the current season.*

A copy of the progress report on the Field work of the Exploratory Sample Census of Jute, 1940, prepared by the Supervisor is attached for the information of the members of the Committee. (*Enclosure*)

2. In this connection members will recall that at its Sixth Meeting held on the 10th October, 1939, the Jute Census Committee decided that the Field Survey this year should be carried on under the auspices of the Indian Central Jute Committee, and the Secretary of the Committee should be responsible for the supervision of the work. As the present Secretary assumed charge of his office in the beginning of May, and had to remain at head-quarters throughout this month, it has not been possible for him to supervise the work on the field for more than twice so far. Much as he would have liked to visit the more important of the districts taken up for survey this year, he is not likely to be in a position to do so in the current season. For the present, he has been working according to the following programme:—

- |                         |  |                                       |
|-------------------------|--|---------------------------------------|
| 1. Presidency Division. | One district<br>(Bongaon—Jessore).       | Visited on the 21st<br>and 22nd June. |
| 2. Chittagong Division. | One district<br>(Comilla)                | Visited on 10th to<br>13th July.      |
| 3. Rajshahi Division    | One or two districts<br>as time permits. | Early in August.                      |

The Secretary regrets that he could not fit in any more visits earlier this season with his other preoccupations, but in view of the three-fold arrangement for detailed supervision of field work by the Field Supervisor, Chief Inspectors, and the Inspectors in charge of field units, it was not perhaps necessary to undertake many more tours. If necessary, Secretary will, however, try his best to visit one or two more districts in connection with the experimental crop-cutting work later in August and in September.

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**ENCLOSURE**

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*Field Work of the Exploratory Sample Census of Jute, 1940.*

1. *Preliminary*: The Supervisor joined his duties on the 3rd April and the Assistant Supervisor on the 27th March. Professor Mahalanobis provided them with a room in the Presidency College and they at once busied themselves with the drawing up of a programme of work, the preparation of instructions under Prof. Mahalanobis's guidance, getting forms and instructions ready and with miscellaneous things necessary to give a start to the operation. It was found that the mauza maps to be used by the Field Section were not all in Calcutta and those in Calcutta were not properly sorted and arranged. The maps left over in mofussil were brought down to Calcutta. A flat consisting of 3 rooms situated at 249/D, Bowbazar Street, was rented. Sorting of maps thanawise and samplewise had to be done in a hurry with the help of the staff engaged since preliminary stage and about a dozen extra men temporarily engaged for the purpose.

2. *Programme*: The eight districts under survey were divided into 6 blocks and 21 sub-blocks. Sub-blocks of low-lying districts were formed in such a way as to contain more or less equal proportions of high and low land. Short programmes were made for low-lying areas in order to complete the survey before the areas were flooded.

Sixteen sub-blocks were included in the programme in the first instance, and it was estimated that 6 Chief Inspectors, 32 Inspectors and 232 Investigators would be required. It was decided that a Chief Inspector would be in charge of a block and two Inspectors in charge of a sub-block. Each Inspector would be given 6 to 8 enumerators who, together with the Inspector, would constitute a unit. Each unit would enumerate the grids of a sub-sample of sub-block.

3. *Recruitment*: It had been decided that 15 Agricultural Overseers and 60 Agricultural Demonstrators of the Indian Central Jute Committee would be available for Jute Census operation. The Director of Agriculture was requested to release these workers and they were posted to the different sub-blocks. An advertisement for the rest of the workers was published in the Amrita Bazar,

Ananda Bazar, Azad and Star of India. A staff of 172 Investigators, 27 Inspectors and 6 Chief Inspectors were selected from the applications received, and appointment letters were issued to them.

4. *Field-work*: A regular office was started during the third week of April in the rooms of the Bowbazar Street. Chief Inspectors started for their mofussil centres with the mauza maps, forms, etc. weighing 10 to 15 mds. on the 22nd and 23rd April. Inspectors and Investigators joined their respective posts at the mofussil centres on the 24th and 26th April, and actual field work started on the 1st of May.

Out of 172 Investigators and 27 Inspectors appointed, 41 Investigators and 2 Inspectors did not join their posts and fresh recruitments had to be made in the mofussil. As a result of this, field work of 7 out of the 32 units could not start before the second week of May.

5. Agricultural Demonstrators did not join in time. One of them joined only on the 25th of June to be transferred back on the 2nd July when the work of his area was completed. Substitutes had to be engaged in place of these workers and these substitutes were discharged when the Agricultural Demonstrators joined.

During the period of  $2\frac{1}{4}$  months of the field work which this report covers, 25 Investigators, 1 Inspector and one Chief Inspector resigned and many workers fell ill. 17 Investigators were granted leave on medical grounds for more than a week. Substitutes had to be engaged in the vacancies thus created. Sometimes much difficulty was felt in getting hold of the right type of recruits and in training them up in elementary field-survey.

Two more sub-blocks were taken up for survey in June. In one of these, a unit of Cyclists consisting of 1 Inspector and 6 Investigators was sent for field enumeration. Six old, reliable and fast workers under a graduate Inspector were transferred from different units to survey the second sub-block. This was done in order to compare the efficiency of a cycle unit and a unit of veteran workers with that of the other ordinary units.

The actual field work undertaken covers an area of about 20,500 sq. miles out of a total of 24,000 sq. miles. Or, in other words, about 14 per cent of the work has been abandoned with a proportionate saving from the budget.

An account of the progress of work up to the 30th June in the first 16 sub-blocks is given below :—

District.	No. of grids allotted.	No. of grids finished up to 30-6-40.	Approximate date of completion of <i>actual</i> field work.
Nadia ...	1,502	1,280	10-7-40
Jessore —	2,562	1,707	30-7-40
Rajshahi ...	1,974	1,763	18-7-40
Bogra ...	3,605	2,580	3-8-40
Rangpur ...	2,770	2,080	25-7-40
Mymensingh ...	16,210	13,675	18-7-40
Dacca ...	6,524	6,098	10-7-40
Tipperah ...	6,364	5,037	15-7-40
<b>Total ...</b>	<b>41,511</b>	<b>34,220</b>	

The above figures show that about 82% of the work was finished by the 30th June. The cycle unit and the other unit which have started late are expected to finish work by the end of August.

5. *Inspection and checking*: About 10% of the grids was checked by the Inspectors. Four Check Inspectors were appointed and they checked about 300 grids during the last two months. The Chief Inspectors also have checked quite a large number of grids and the Supervisor and the Assistant Supervisor were able to inspect the work in all the districts. The Secretary himself inspected field work in Jessore and Comilla, giving valuable advice and instructions on both the occasions.

(Sd.) S. K. BANERJI,

*Supervisor.*

CALCUTTA,

*The 16th July, 1940.*

## APPENDIX V

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NOTE BY THE SECRETARY DATED THE 18TH JULY, 1940, ON SUBJECT NO. 6.—*To consider the question of retention of the services of Mr. S. K. Banerji and Mr. D. M. Ganguli, Supervisor and Assistant Supervisor respectively, up to the beginning of October, 1940.*

Members of the Committee will recall that, when the Committee addressed the Government of Bengal for the loan of an officer of the Bengal Civil Service for employment as Field Supervisor in connection with the field work that was to be carried on in eight important jute-growing districts of this Province, the Government of Bengal were given to understand that the services of this officer would be required for a period of five months only. Accordingly, the services of Mr. S. K. Banerji, Deputy Magistrate and Deputy Collector, were placed at the disposal of the Indian Central Jute Committee with effect from the 3rd April, 1940. Mr. Banerji's term of appointment will expire on the 3rd September, 1940. In view of the proposals regarding crop-cutting experiments, which have been placed before the Committee and which are not likely to be completed till the first week of September, it seems to be essential to move the Government of Bengal for the extension of Mr. Banerji's services till the beginning of the Puja holidays. Even if the crop-cutting experiments are completed, according to schedule, in the first week of September, his services will be necessary for some time longer for winding up the office, writing report on the field portion of the work and for some other matters.

2. As regards the services of the Assistant Field Supervisor, Mr. D. M. Ganguli, a Statistical Assistant employed in the Statistics and Information Section of this office, a similar arrangement is also necessary for similar reasons. The members will remember that Mr. Ganguli's services were transferred from the Statistics and Information Section to the Jute Census Scheme for a period of two months in the first instance; afterwards, at the request of Prof. P. C. Mahalanobis, the term of his deputation was extended to 4 months. In view of the scheme of crop-cutting experiments now proposed to be taken up, it seems that

his term will have to be further extended till the beginning of the Puja holidays. The work in the Statistics and Information Section has suffered considerably on account of Mr. Ganguli's deputation elsewhere. He was the seniormost clerk in this Department and was the only clerk who could be relied upon for complicated statistical analyses. The Assistant Economics Officer has suggested that, if Mr. Ganguli's term of deputation with the Jute Census Scheme has to be extended by another two months, he will require the services of an additional hand. This matter is now under the consideration of the Secretary. For the present, however, it seems that since the Committee approved of Mr. Ganguli's deputation to the Jute Census Scheme for a period of 4 months, they might also agree to the extension of his term till the Puja holidays.

3. It may be mentioned in this connection that, in addition to their work in connection with the area-survey and crop-cutting experiments undertaken during the period of their term of appointment which is now proposed to be extended, they will be also employed on the work regarding the collection of maps—a subject which has been discussed in the Secretary's note on Item No. 8 of the Agenda of this meeting.

4. Necessary budget provisions for the proposed extensions of the terms of appointment of the Field Supervisor and the Assistant Supervisor have been made in the Revised Budget Estimates of the Field work.



**APPENDIX VI**

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NOTE BY THE SECRETARY DATED THE 17TH JULY, 1940, ON SUBJECT TO 7.—*To consider the question of addressing the Government of Bengal, Agriculture and Industries Department, about the Bengal Government's contribution towards the cost of the next year's work.*

The members will recall that in his note dated the 10th October, 1939, circulated among them at the Seventh Meeting of the Jute Census Committee (printed on pages 156-158 of the Proceedings of the Seventh Meeting of the Jute Census Committee) Prof. P. C. Mahalanobis estimated that Rs. 2,16,500 would be required for undertaking a full scale Provincial Sample Census in 1941. This was obviously a guess figure, for it was too early then to make even a very rough estimate of the probable cost. While it is not possible even now to give any definite figure of the cost for the next year's work until this year's survey has been completed and the materials arising out of it have been examined, the Secretary has ascertained informally from Prof. Mahalanobis that the probable cost of the Provincial Survey will not exceed Rs. 1,80,000. It need hardly be stressed that this is only a rough estimate of the probable cost of next year's work; but at this stage this may be taken as the nearest approach to the amount likely to be required. Having regard to the costs incurred up to date for this year's Survey, this appears to be a reasonable figure on which the Committee can base its estimate for the next year's work.

2. There is already available a sum of Rs. 30,000 which was allotted for preliminary work for the 1941 survey. The balance of Rs. 1,50,000 may be provided jointly by the Indian Central Jute Committee and the Government of Bengal on a 50: 50 basis. In the budget estimates of the Indian Central Jute Committee for 1941-42, it is proposed to provide Rs. 75,000 for the "Scheme for the Improvement of Jute Forecast", and it is suggested that the Government of Bengal may now be requested to provide a similar amount in their budget for the next financial year.

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## APPENDIX VII.

NOTE BY THE SECRETARY DATED THE 16TH JULY, 1940, ON SUBJECT NO. 8.—*To consider the question of collection of maps as part of the preparatory work for the Provincial Survey to be undertaken in 1941.*

As the members of the Jute Census Committee are aware, the collection of Mouza maps has been one of the most important items, in the preparatory work undertaken for the field surveys of the last few years. During the last cold weather the collection of maps was very considerably delayed, with the result that while the work at the Statistical Laboratory was held up towards the end of the year it had to be rushed through at the beginning of the current year. Much avoidable confusion took place in the arranging and despatch of maps to the field workers which, in its turn, delayed field operations to an appreciable extent. In order to obviate these inconveniences and difficulties, the Secretary proposes that the work of collection of maps for the next year's Provincial Survey should be undertaken by a small staff immediately after the field work in connection with the area-survey is over in the beginning of August. As the next year's field operations will cover all the important jute-growing districts of this Province, a much larger number of cadastral Mouza maps will have to be collected this year than they were in the last. The work at the Statistical Laboratory will also considerably increase. It is therefore very necessary that this work of collection of maps should be taken in hand at the earliest possible opportunity, so that the work at the Statistical Laboratory may be completed in good time and the field operations for the Provincial Survey of 1941 may start at the earliest possible date. The Field Supervisor will have no difficulty in supervising this work in addition to his other duties. For, when the operations relating to the area-survey are over, all that will remain for him to do, apart from office work, will be the supervision of the field work in connection with the crop-cutting experiments in four Thanas.

2. The following staff will be required for a period of about six weeks say, from the 7th August, 1940, and the total expenditure

is estimated to be Rs. 1,500 which will be met out of the provision of Rs. 30,000 allotted for the preparatory work :—

(1) 24 Investigators @ Rs. 25/- p.m. each for six weeks	...	...	...	Rs. 900/-
(2) 12 Peons @ Rs. 13/- p.m. each	...	...	...	Rs. 239/-
(3) Travelling allowance, etc.	...	...	...	Rs. 361/-
				Rs. 1,500/-

The above estimate provides for 2 Investigators and 1 Peon in each of the 12 districts from where the maps will have to be collected. It may be pointed out that out of the 24 jute-growing districts in Bengal, 4 in which the area under jute is small, will probably be omitted. Of the remaining 20, maps are already available in respect of 8 districts in which the survey was conducted this year and, except a small number of missing sheets, no maps would be required from those.

3. The members will note that, if the collection of the Mouza maps can be completed before the Puja holidays, it will not be necessary to take up the remainder of the preliminary work in connection with the Provincial Survey of 1941 till the beginning of that year. It is expected that this will result in considerable saving of expenditure on the preparatory work for the next season.

## APPENDIX VIII.

*Notes on the Subjects for the Meeting of the Jute Census Committee, 25th July, 1940.*

By P. C. Mahalanobis.

I am giving below a few comments and explanatory notes on some of the subjects which will be considered by the Jute Census Committee on the 25th July, 1940.

2. *Subject No. 2: Statistical Report on the Crop-cutting Experiments on Jute, 1939.* The report was completed on the 13th July, and the actual cost has not yet been worked out. The estimated cost of Rs. 1,400 is only an approximate figure.

3. *Subject No. 4: (c) Additional expenditure of Rs. 1,500 in the Statistical Laboratory.* For a clear understanding of the situation, it is necessary to reproduce some of the details from my Note of the 6th July, 1940, sent to the Secretary.

(i)	Jurisdiction Lists were not sent to the Statistical Laboratory until February, 1940; consequently, these lists had to be copied out by hand which required an additional staff of about	...	9 man-months
(ii)	Maps were sent to the Statistical Laboratory without any accompanying chalan; fresh chalan had to be prepared for comparison with Jurisdiction Lists	... ..	7 man-months
(iii)	Transfer Lists were not supplied; these had to be copied from the D. L. R.'s office	... ..	4 man-months
(iv)	There was great delay in receiving Khasmahal maps; a large number of sheets already marked with grids had to be rejected and new sheets prepared		5 man-months
	<b>Total :</b>		<b>25 man-months</b>

The point I wish to emphasize at this stage is, that it was necessary to incur an expenditure of 25 man-months, the cost of which was not provided in the budget. The expenditure may be adjusted, of course, through book transaction as suggested by the Secretary.

4. *Subject No. 4: (e) Mounting of Maps.* I think a word of explanation is necessary regarding the expenditure for mounting the maps on linen. The Committee approved of this proposal in December, 1939. At this time Rs. 17,000 had been provided for the purchase of maps, and I was authorized to utilize the balance for mounting maps. As the total cost of the maps was less than Rs. 12,000, I naturally proceeded on the assumption that Rs. 5,000 would be available for mounting and spent about Rs. 4,700 for this purpose. Unfortunately, owing to excess of expenditure for preparatory field work, the provision for maps had to be reduced subsequently to Rs. 16,000. This caused the present excess expenditure of about Rs. 700 for which, however, the Statistical Laboratory was not responsible in any way.

5. *Subject No. 8: Collection of Maps.* I strongly support the Secretary's proposal to begin the collection of mauza maps immediately after the field work is over. It will greatly facilitate and expedite the preparatory work if the maps can be supplied to the Statistical Laboratory before the Puja vacation.

6. For the 8 districts in which work was done this year, new maps will have to be purchased for the Laboratory portion of the work. This is because the old maps have been already marked with grids; and also because they will be used for model sampling experiments and zoning studies. As regards field work, we mounted 35,039 maps on linen last year; these need not be purchased again. This left 21,706 maps not yet mounted (out of a total of 56,745 sheets belonging to the field set); it will be necessary to replace the missing and the worn out sheets among these. The additional expenditure for 8 districts on a *pro rata* basis will be Rs. 1,000; it will be necessary; therefore, to provide Rs. 2,500 to meet the expenditure for the collection of maps.

*Need of Reducing the Cost of Maps*

7. I have repeatedly drawn the attention of the Committee to the need of reducing the large recurring charge for maps. This is essential if it is intended to carry out a sample census every year. I am making experiments with an optical method which, if successful, will reduce very considerably the expenditure for the work with maps in the Laboratory. It is suggested, therefore, that some special provision should be made for this purpose, and the allotment for the cost of maps should be included in the grant for the statistical work on the understanding that savings under this head would be utilized for the photographic and optical experiments.

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Corrigenda to the printed Proceedings of the  
Tenth Meeting of the Jute Census Committee.

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Page 2, para 3.

For "Mr. Sen said that at Dacca the practice  
was to name the 'Daisee' as 'Capsularis'".

Read "Mr. Sen said that in Dacca and neighbouring  
areas sometimes the practice was to name  
'Capsularis' as Deshi in the sense of being  
indigenous which was quite different from  
'Daisee' and the mistake probably arose from  
confounding Deshi and 'Daisee' and in  
assuming that 'Daisee' and 'Tosha' were  
of different species."

Page 3, para 4.

For "girth"

Read "height"