CONFIDENTIAL

INDIAN CENTRAL JUTE COMMITTEE

FIRST REPORT

ON THE

CROP CENSUS OF 1938

By

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Section I. Introduction

History of the scheme

1. In May 1938 while I was engaged in analysing the results of the Experimental Crop Census conducted in 1937 (on which I submitted a Statistical Report in August 1938) I had the opportunity of discussing with Mr. H. Graham, I.C.S. (then Secretary, Department of Agriculture and Industries, Government of Bengal), the question of the Jute Census in Bengal. I sent him a note in this connexion on the 17th May 1938 in which I proposed that an Exploratory Survey should be conducted during the 1938 season. I also suggested that a special Jute Census Committee should be formed for this purpose, and a block grant of Rs. 50,000 should be placed at the disposal of this Committee for the proposed survey. The matter was taken up by Mr. Cliff, Secretary, Indian Central Jute Committee, and as the result of further discussions between him and Mr. Graham, the Government of Bengal approved on the 15th June 1938 the proposal of conducting an experimental survey in 1938, and agreed to the appointment of a special Jute Census Committee for this purpose. The total grant for the survey was however fixed at Rs. 35,000 instead of Rs. 50,000 originally suggested by me. A Scheme was prepared by me on this basis on the 26th June which was generally approved at the first meeting of the Jute Census Committee on the 6th July 1938. It was also decided that some work should be attempted in the districts of Mymensingh, Dacca, Rajshahi, Tipperah Pabna, 24 Parganas, Rangpur and Murshidabad; but it was left to me to select the thanas in each district keeping in mind the intensity of cultivation and difficulties of communications.

Field work

2. Babu Nihar Chandra Chakravarti, M.A., B.C.S., Secretary, Board of Economic Enquiry, Bengal, who was placed on special duty by Government as Supervisor of the Field Branch, started work in the Statistical Laboratory on the 8th July. Between 8th and 12th July the office staff was recruited; and between 13th and 18th July the Supervisor visited Mymensingh, Dacca, and Tipperah to inspect the local conditions and to arrange for the purchase of cadastral maps. Owing to the very early rise of floods not a single thana as a whole was found to be dry in any of these three districts. In this situation, it was decided to start work in thanas which were found to be comparatively dry.

3. The recruiting of the field staff started on the 19th July. During the next 10 days about 60 men were appointed as Inspectors, Assistant Inspectors or Enumerators. They were given a certain amount of training in the Statistical Laboratory as well as in the field near Calcutta by the Supervisor, and began to be sent out to the districts from the 21st July. Field work was started in all the districts between 27th July and 5th August and was continued practically up to 10th October 1938. Only in Rajshahi district, where the field enumeration could not be finished before the Puja holidays, work was resumed on the 8th October and was completed on the 21st October.

4. The work of compiling the area of individual plots from the *khatian* in the office of District Collectors was done by the field staff. During October and November a good deal of crop schedule work was also done by them.

5. Very early and exceptionally heavy floods occurred in 1938 in East and North Bengal. Many of the villages which were dry at the time of starting the survey gradually went under water. Field work had therefore to be suspended or abandoned in many of the areas and new villages and in some cases new thanas had to be taken up for survey. This naturally caused delay and retarded progress. The Supervisor has prepared a report on the work of the Field Branch which is given in Enclosure.

6. The amount of field work completed during the 1938 Survey is shown in tabular form in Table 1. The information collected in the form of random samples was comparatively small owing to the early rise of flood water and other difficulties mentioned in the Supervisor's Report. But valuable material has been collected in the form of complete enumeration for over 400 square miles which will offer a good deal of scope for model sampling experiments in the Laboratory.

Statistical work

7. A portion of the statistical staff which had been engaged on the analysis of the material collected during the 1937 Survey was set on the task of making preliminary arrangements for the present survey. Necessary forms for field enumeration, instruction to enumerators, tabulation sheets etc, were prepared and printed between the period 13th and 25th July. Cadastral maps were purchased and were received in Calcutta between 26th July and 3rd August ; and actual preparation of sample grids was started on the 27th July, and was continued till the end of September.

General observations

8. The work of organising the 1938 survey, I am glad to note, proceeded rapidly and smoothly. This was facilitated

by two things : (1) The existence of a small group of thoroughly reliable and trained statistical workers, and (2) the experience gained during the Crop Census of 1937 and the subsequent analysis of the data.

9. On the field side, credit is due to the Supervisor who organized the field work with great ability and efficiency. His previous experience of sampling surveys was most useful in this connexion.

10. On the statistical side, the illness of Subhendu Sekhar Bose, the chief Statistician of the Statistical Laboratory, was a great handicap ; and his untimely death after an emergency operation on the 3rd November was a serious loss. S. N. Roy, K. R. Nair, and K. Kishen in supervision work, J. M. Sengupta, P. K. Chatterjee and J. N. Taluqder in computations gave me their ungrudging help. As regards general administration, I am particularly indebted to S. K. Banerjee and A. N. Bose.

The present report

11. I have never been in favour of rushing through the statistical analysis of material of the present type. This for two reasons : the requisite number of adequately trained computers are not available ; and secondly because in statistical analysis there are certain aspects of a question which can be taken up for consideration only after certain other aspects have been studied in detail. However, as it was desired that I should try to get the report ready as early as possible, I made every attempt to accelerate the statistical work by employing a large number of junior computers in October and November. As most of these men were not trained, the output fell off considerably while the number of mistakes increased causing an increase in the cost of checking and supervision. As funds were running short and as no orders were received from Government regarding the continuance of the Scheme during the 1939 season, the position became serious at the end of November. After discussing the question with Mr. Cliff I discharged about two-thirds of the temporary staff from the 1st December. The result was that work in many branches had to be rearranged and certain aspects of the analysis had to be discontinued. This retarded progress very materially.

12. Mr. Cliff has however impressed on me the need of submitting a report by the end of December 1938 so that it may be circulated in time for being taken up for consideration at the meeting of the Indian Central Jute Committee in the first week of February 1939. I am therefore writing the present report in a great hurry and on the basis of the analysis completed so far.

Section 2. Accuracy of Field Work.

13. As in the case of the 1937 Survey an attempt has been made to test the accuracy of the field enumeration by a plot to plot comparison where more than one set of results happened to be available. As the crop schedule work has not been completed at the time of writing this report, the comparison can only be made in terms of number of plots and not in terms of areas. Subject to this explanation, Tables 2(T/1)—2(T/8) and 2(M/1)—2 M/8) show the results of the comparison.

14. The absolute discrepancies are again quite high showing that accuracy reached in practice by untrained workers is low. A word of caution is however necessary. The comparison of the records this year had to be carried out mostly by untrained workers. It is possible therefore that some of the discrepancies occurred not in the field enumeration but at the stage of comparison. I hope to be able to arrange a careful checking of the comparison at least in certain cases, and to report the results later on.

15. The algebraic sums of discrepancies are naturally much smaller. This shows that the errors committed in the stage of primary enumeration are to a large extent of the kind known as chance errors in statistical theory. These chance errors are sometimes positive and sometimes negative, and cancel out on addition. Naturally the larger the area over which the total is taken, the lower will be the algebraic discrepancy. On the whole this is actually found to have occurred in practice.

Section 3. Variations in Output and Accuracy.

16. The question of organization is one of great importance. Many aspects of this question will require detailed consideration if and as the Scheme progresses. I shall merely touch upon the question of individual variations in output. Indices were calculated on the lines explained in Section 8 of my Statistical Report on the 1937 Survey, and are given in Table (3·1).

17. The wide variations in the individual indices of output will be immediately noticed. For example, in the case of field investigators doing complete enumeration we find that the index falls to such a low value as 28 (serial No. 29 in the list) and rises as high as 157 (serial No. 54)—a difference of over 5 times between extreme limits.

18. The output index by itself is, however, not sufficient. The accuracy of the work is of outstanding importance. We have, therefore, also calculated indices of mistakes, and have used these indices to construct adjusted or net indices of output corrected for frequency of mistakes.

19. These adjusted indices are given in col. (3) of the same Table (3·1). It will be noticed that the variations are now even larger. In fact, in one or two cases, the index actually becomes negative. This means that the number of mistakes is so large, and so much time is consumed in correcting these mistakes, that the expenditure incurred in making the corrections is actually greater than the cost of the original calculations. In employing such men, not only no value is received in return for the salary paid, but actually money is lost in allowing them to work at all.

20. The output index in the Laboratory portion of the work given in Table (3·2) also shows wide fluctuations. The need of careful selection and training of workers is obvious. Large savings should be possible by using output and accuracy indices to regulate continuance of appointments as well as basic rates of pay.

Section 4. Accuracy of Sample Surveys.

21. The question of the accuracy of sample surveys is fundamental in the present problem. In a previous note I have tried to explain in non-technical language the essential principles underlying the sampling method; but it will be convenient to recapitulate here the leading ideas.

22. Our object is to make a reliable estimate of the total acreage under jute in the whole province. If a complete census of all plots can be carried out with accuracy, it would give not only the total jute acreage for the area as a whole, but also detailed information regarding each individual plot, *mauza*, union thana, or district. This would undoubtedly be the ideal solution I have, however, already explained in my Report on the 1937 Survey that it would be difficult to carry out a complete enumeration owing to the lack of trained and reliable workers. Even if the organizational difficulties could be overcome, the cost would be high and of the order of 12 or 15 lakhs of rupees ; and the results would be untrustworthy.

23. In the sample survey we do not make an attempt to enumerate all the plots, but examine only a very small fraction scattered at random over the whole area. The contrast between the two methods should be carefully noted. When properly conducted, the sample method will give an almost equally reliable estimate of the total acreage for the province as a whole, but will not give reliable information regarding individual plots or *mauzas*.

The sampling error

24. Two important quantities occur in our present problem. One is the actual proportion or percentage of land under jute,

which I shall call "p". In any given area, we survey a number of sampling units or grids of uniform size scattered purely at random over the area. We thus obtain a definite value of p for each individual grid. Now these individual value of p will in general differ from one another; and in order to obtain a representative value for the given area, we naturally calculate the average value of p by adding all the individual values and dividing by the total number of grids. Finally, multiplying this average value of p by the total area in acres of the given region we obtain the total acreage under jute in the given region.

25. The second important quantity is the variability of the individual values of p. If these values differ only a little from one another; the variability will be small; if they differ much, the variability will be large. It is convenient to define a precise measure of this variability which is called a "standard deviation" and is usually written as "s". (It is easy to see in a general way, without using mathemetical formulae, how this can be done. We first write down the difference between each individual value of p and the average value. The magnitude of these differences, which are called the 'deviations' of the individual values from the average value, obviously determine the variability. As some of the deviations are positive and some negative, it is not possible to add them directly; in fact, their sum will be necessarily zero. We therefore square each deviation and add these squared deviations, and obtain the mean value. Extracting the square root, we get a representative value of the deviation which is called the "standard deviation", and which furnishes a convenient standard for measuring the variability). I shall now indicate briefly how this standard deviation s, which measures the variability of the proportion of land under jute, is used in practice to furnish information regarding the accuracy of the sampling method.

26. A little consideration will show that the reliability of the average value of p, (which we may write as $\bar{p}$), will depend on the variability of the observed individual values of the proportion under jute (p) in different grids. Let us consider a hypothetical case and suppose that there are "n" sampling units in a given thana; and also suppose that they all show the same value of p; for example, say 5 per cent of each grid under jute. In this case we can clearly assert with complete confidence that exactly 5 per cent of the whole thana is also under jute. On the other hand, suppose the proportion of jute in individual grids varies from, say, zero to 50 per cent; but suppose the average value is same, *i. e.* 5 per cent, as before. In this case, although we shall obtain an identical estimate of the acreage under jute in the thana as a whole, the reliability of the estimate will be much less. It is clear that the unreliability or sampling error of the estimate will increase with the variability of p, the proportion under jute in individual grids.

27. But this is not all. The reliability of the estimate will also depend on the number of grids on which the average is based. Here also it is easy to see, without entering into mathematical considerations, that (provided variability remains constant) the larger the number of grids the greater will be the confidence which we can place on the result. For example, suppose in a particular thana we conduct two experiments, the first experiment with only, say, 25 grids, and the second experiment with, say, 2,500 grids. (As both the surveys are conducted in the same thana, the variability will be same). Suppose in the first case we get an average proportion of 5 per cent of land under jute, and in the second experiment of, say, 10 per cent. It is clear that we shall have no hesitation in accepting the result of the second experiment as more reliable. Mathematical investigation shows that the reliability of the result will increase proportionally to the square-root of n, the number of grids used in the experiment. The result of the second experiment will be, therefore, roughly ten times more reliable than the result of the first experiment.

28. These are the two fundamental principles relating to the reliability of averages. A combined statement may be given in the following forms :—

"The sampling error of an observed average is directly proportional to the variability (s), and inversely proportional to the square-root of n, the number of samples on which the average is based."

This may be conveniently written in an algebraic form :—

$$\text{Sampling error of average} = \frac{s}{\sqrt{n}}$$

We may, if we like, express this result in the form of percentages.

The advantages of zoning

29. In Jute Census work it will be necessary to cover roughly 55,000 square miles comprising about 330 thanas. We know that the proportion of land under jute in different thanas fluctuates very widely. In certain thanas there is scarcely any jute ; in other thanas, it may cover as much as 40 or 50 per cent of the land. The variability (s) of the area as a whole will therefore be necessarily large. It will be convenient, therefore, to divide the whole area into a suitable number of zones each of which will be as homogeneous as possible in regard to the intensity of cultivation *i.e.*, the proportion under jute. This is why I have already proposed that we should try to work with, say, about 400

zones each roughly of the same size as a medium sized thana. If these 400 zones are suitably demarcated, the variability within each zone may be kept fairly small. The reliability of the estimate for the province as a whole may, in this way, be increased very considerably.

The need of large samples

30. In the case of jute, owing to its being cultivated in widely scattered plots rather than in compact blocks, the variability even within a single zone will be very high. For example, for 16-acre grids the variability in Deganga thana (1937) was found to be 200 per cent. Let us suppose that the whole area is divided into 400 zones as proposed by me. The variabilities (s) of the different zones will of course be different, but let us assume for the present that they are all roughly of the same order, say, 200 per cent for 16-acre grids. Now, if we want our final estimate for the province as a whole with a standard error of say one per cent, then it is clear that n must be as large as 40,000.

31. In the above calculations we have assumed the variability of all the zones to be same. As already noted, the variabilities will however in fact differ considerably from zone to zone. The actual number of grids required to reduce the sampling error to about one or two per cent will therefore be considerably larger than the figure obtained above ; it is however of the right order. We find then that a very large number (of the order of say 40,000 grids of size 16-acre) will be required to attain a reasonable accuracy in the estimate for the province as a whole.

Uncertainty in the estimates for individual thanas or zones

32. Although the total number of grids for the whole area is large, the number of grids in each zone will be fairly small and of the order of, say, 100. The sampling error of the estimate for individual zones will be therefore quite high. Let us assume, as before, that the variability $s = 200$ per cent. As $n = 100$, and $\sqrt{n} = 10$, we see that the sampling error for individual zones will be as high as 20 per cent for 16-acre grids.

33. The point to be emphasized is however that in spite of a large margin of error in the results for single zones, it is possible to attain a high accuracy in the estimate for the province as a whole. This is a characteristic feature of the statistical method. (This principle is, of course, quite familiar in practical life. For example, in insurance business, we are completely ignorant as to the chance of death of individual persons, and yet we can

calculate with considerable accuracy the risk of death of a group of persons ; and the larger the number of persons included in the calculation, the greater is the accuracy of the result). The success of the sampling method depends entirely on distributing the risk of error over a large number of units ; so that, in this case safety very definitely lies in large numbers.

34. Another aspect of the same fact deserves consideration in the present connexion. It is sometimes suggested that the possibilities of a sample survey should be first established for a small portion of the whole area. There is a methodological contradiction in the very attempt. Let us consider again a single zone with a variability of 200 per cent as before. In order to attain an accuracy of say one per cent,. we shall again require 40,000 grids or exactly the same number as would be required to attain the same accuracy for the area as a whole. But such a high intensity of sampling for a single zone will obviously have no relation to the actual conditions under which a survey will have to be conducted over the whole area. The fact of the matter is that if we use an intensity of sampling (say, of the order of 100 grids per zone) which is adequate for a full scale survey, the results for individual zones or small groups of zones are bound to have a large margin of error, and are bound to appear as thoroughly unsatisfactory to the uninitiated. (The position is something analogous to what would happen if an insurance company is asked to demonstrate the practicability of insurance by operating with say not more than five or ten insured lives. It is obvious that either the premium would have to be increased several hundredfold or the scheme would completely break down). The only proper method of exploring the possibilities of a sample survey is to extend the work over a wide area. In fact, the wider the area included in the survey, the greater will be the accuracy attained by the sample method.

Valid test of sampling experiments

35. One point requires emphasis at this stage. It must be remembered that the only adequate and valid test of the success of sampling experiments is furnished by the sampling error defined above in para 28. For this purpose, it is convenient to use a suitable multiple of the sampling error to give a permissible limit of error. For example, we may use (approximately) twice the sampling error as our critical error. Statistical theory tells us that in this case, if the sampling experiment is properly carried out, the observed discrepancy between the result of a sample survey and the true value of the acreage under jute should not exceed this critical value more than once in twenty trials. In other words, the odds are roughly 20 to 1 against an observed discrepancy being greater than a critical value of about twice the sampling error.

36. It is clear then that the only proper method of judging the results of a sampling experiment is to compare the observed discrepancies between the sample estimate and the true acreage with the corresponding critical values. If the observed discrepancies are on the whole less than the critical values, the sampling experiment must be considered to be quite satisfactory. The magnitude of the discrepancy by itself, that is, apart from the corresponding critical value of the margin of error, has absolutely no significance.

Model sampling experiments of 1937-38

37. In my note of the 23rd October 1938 I have already discussed the results of the sampling experiments conducted on the materials collected in 1937. I am reproducing below the relevant portions of this discussion for convenience of reference.

38. Table 16 of my "Statistical Report on the Experimental Crop Census of 1937", gives the average acreage under jute in each Union separately as estimated by (*a*) the method of complete enumeration, and (*b*) the method of sample surveys (most of which were model experiments conducted in the laboratory). The values of the sampling (or standard) errors are also given in the same Table 16. We can now compare the actual discrepancy with the corresponding standard error ; if the discrepancy is less than, say, twice the standard error then the agreement may be considered satisfactory ; otherwise the result is bad.

39. The comparsion is usually carried out with precision by using what is technically known as the "*t*"- test. The values of "*t*" (which represents the observed discrepancy divided by the corresponding standard error) for each comparison in Table 16 were given in a supplementary Table which was placed before the meeting of the Jute Census Committee on the 1st September, 1938. It is reproduced below as Table A(16) for convenience of reference. The cases in which the value of "*t*" exceeded the critical value (on the one per cent level of significance) have been underlined in the Table. It will be noticed that out of 57 results for individual Unions, in no less than 52 cases the observed discrepancy is less than the critical margin of error ; while the different sampling estimates for the thana as a whole all lie within the expected margin of sampling errors.

TABLE A(16).

Values of "t" with degrees of freedom for comparisons given in Table 16 (p.70 of the *Report on the 1937 Survey*).

Union No.	Random Plot.		1 acre grid.		4 acre grid.		5 acre grid.		16 acre grid.		36 acre grid.	
	t.	D.F.	t.	D.F.	t.	D.F.	t.	D.F.	t.	D.F.	t.	D.F.
1	0·86	570	1·00	38	0·75	21	1·18	56	0·13	14	0·04	14
2	1·62	980	1·72	61	0·26	33	1·07	88	0·85	23	1·97	22
3	0·21	552	0·17	40	0·19	23	0·71	51	2·30	15	0·62	14
4	0·12	793	0·26	44	0·23	25	0·57	58	1·57	16	0·28	18
5	1·47	804	0·73	51	0 42	31	0·18	78	0·81	20	0·33	18
6	0·41	1047	0·85	59	0·85	31	3·28	98	0·76	22	0·02	22
7	2·61	1123	1·23	63	0·80	39	3·51	111	1·20	23	0·11	21
8	1·56	845	2·18	67	...	35	0·29	89	0 39	23	0·30	25
9	0·36	1010	0·47	68	1·32	35	0·93	93	3·40	25	0·76	25
10	0·44	910	...	58	...	33	2·76	78	0·56	24	0·71	24
Total	1·22	8544	0·003	549	1·47	306	0·53	800	1·18	205	0·04	203

40. A numerical illustration may make the position clear. Let us consider the case of Deganga Thana Union No. 2 for which the relevant figures are given in the following Table B(16).

TABLE B(16).

Results of Sampling Experiments for Union No. 2 (Deganga 1937)

Size of grids.	No. of girds (n).	$\sqrt{n}$	Standard Deviation.	Standard Error.	5 per cent "t"	Area under Jute.		Critical Error	Observed value of "t"
						Estimated.	Discrepancy.		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Random Plots.	981	31·32	804·3	25·68	1·962	76·12	+41·60	±50·38	1·62
1—acre	62	7 874	106·1	13·48	2·000	11·30	−23·23	±26·96	1·72
4—acre	34	5·831	273·2	46·86	2·042	46 75	+12·23	±95·69	0·26
5—acre	89	9·434	653·6	70·34	1·907	109·69	+75·17	±139·77	1·07
16—acre	24	4·899	74·5	15·21	2·069	21·58	−12·94	±31·47	0·85
36—acre	23	4·796	41·6	8·69	2·074	17·38	−17·14	±18·02	1·97

Area under jute by complete enumeration = (34·52)

Let us consider 4-acre grids. The number of grids was $n = 34$ (col. 2); and the square root of n is 5·831 (col. 3). The observed variability or standard deviation was $s = 273·2$ (col.4). Dividing this quantity (273·2) by $\sqrt{n}$ (5·831), we get the standard error 46·86 given in col. 5. If we use odds of 20 to 1, then we shall have to multiply the standard error roughly by 2 in order to obtain the critical margin of error. A more exact value of the multiplier is given by "t" shown in column 6. In the present case, multiplying the standard error by $t = 2·042$, we get the critical margin of error of $\pm 95·69$ shown in col.9. Now the estimated value of the acreage under jute based on 4-acre grids was 46·75 acres (col. 7), while the value obtained by complete enumeration was 34·52 acres (shown at the bottom of col. 7). The observed discrepancy was thus $+12·23$ acres which is less than the critical limit of $\pm 95·69$. From the point of view of statistics, the discrepancy is, therefore, negligible; and the agreement is satisfactory.

41. As I have already noted, this is the only valid method of comparing the results of sampling experiments. Every statistical estimate has its own sampling error; and so long as the discrepancy (i. e. the difference between the estimated and the true value) is not large in comparison with this sampling error, the result must be considered satisfactory.

42. Keeping this principle in mind, let us examine columns (8) and (9) of Table B (16) for Deganga (1937). It will be noticed that in every case, without a single exception, the observed discrepancy (col. 8) is less than the critical margin of error (col. 9). From the point of view of statistical theory, the results of all the sampling experiments in 1937 were entirely satisfactory.

43. I may explain here that in actual statistical practice the usual procedure is to calculate the observed value of "t" (shown in col. 10). This is simply equal to the observed discrepancy (col. 8) divided by the standard error (col.5). If the observed value of t is less than the corresponding 5 per cent (because we are working with odds of 20 to 1) value of t shown in col.6, the agreement is considered satisfactory. The observed values of "t" for the other comparisons are given in Table A(16) for Deganga 1937.

44. The real fact is that, owing to number of samples being small (in comparison with the variability), the margin of error is very large. This point is so important that it deserves a little more consideration. Let us take Union No. 2, and sample grids of size 4-acre. The variability (expressed as a percentage) is 585 per cent; and the actual number of grids is 34. The standard error, again expressed as a percentage, is roughly 100 per cent; and the margin of error (on the 5 per cent level) is about 200 per cent. Let us use the same intensity of sampling (*i.e.* 34

grids per union) but over a wider area of, say, 10 unions or one thana ; the number of grids will now be 340, and the margin of error will be reduced to about 60 per cent. Let us increase the area to a medium size district comprising, say, 16 thanas or 160 unions ; the number of grids will be 5440 ; and the margin of error will be reduced to about 16 per cent. Finally, if we conduct the experiment over the whole province comprising 330 thanas, the total number of grids used will be about 1,12,000. If the full scale survey is no worse than the model sampling experiment in the case of Union No. 2, the margin of error will be reduced to less than 4 per cent, which is not unsatisfactory. In other words, the result of the model sampling experiment in Union No. 2 with 4-acre grids is sufficiently accurate to give us confidence in thinking that, if a provincial survey can be conducted in the field with the same accuracy, then we may reasonably expect to obtain a final estimate with a margin of error of only 3 or 4 per cent.

Section 5. Sampling Experiments on the Field in 1938

45. We have been considering so far, with one exception, model sampling experiments in the Laboratory based on the complete enumeration carried out in Deganga thana in 1937. We shall now consider the results of sampling experiments actually carried out on the field during the 1938 season.

46. As already noted, owing to exceptionally high floods much of the area where work was at first started had to be abandoned ; so that the material collected fell considerably short of our original programme. However, in spite of unforeseen difficulties, a good deal of valuable data has been collected which I shall now discuss.

47. Table (5·1) shows the estimated proportion under jute in seven different thanas based on random sample surveys conducted with sampling units of size 1, 4 and 16-acre. The sizes of the samples for one-acre grids were reasonably large, and the results for this particular sampling unit are fairly reliable. In the case of 4-acre grids also, the samples are not too small ; but for 16-acre grids the data available are unfortunately very meagre. It will be noticed, however, that the estimated proportions given by grids of different sizes are in reasonable agreement. I shall discuss this question in greater detail a little later.

48. Table (5·21) gives the actual values of the standard deviations for different sizes of grids (together with the corresponding values for random plots to enable a comparison being made with the theoretical values based on the binomial distribution). The standard deviations naturally decrease as the size of the grid is increased ; but not to the same extent as a truly binomial distribution.

49. The next Table (5·22) shows of percentages and are obtained by simply dividing the standard deviations "*s*" by the corresponding value of "*p*" (that is the proportion under jute) and expressed as percentages. These percentage variabilities are of importance in deciding the optimum size of grids which has been discussed in a later Section.

Satisfactory agreement between results of sample surveys

50. It will be useful at this stage to discuss the question of agreement between the estimates obtained from random sample surveys with different sizes of grids. During the 1938 survey a wider ground was covered by the sampling method than by complete enumeration. We are therefore unable to make a direct comparison of the sampling estimates against the results of complete enumeration. We can however compare the estimates obtained from different sampling experiments. This is actually a more satisfactory method for the purpose we have in view. It gives us direct information as to the kind of results which we are likely to obtain by the sampling method.

51. Let us consider, for example, the results of sampling experiment in thana Iswarganj in district Mymensingh, shown in full detail in Table (5·3). Column (1) of this table gives the size of the sampling unit, and column (2·1) the number of sampling units, "*n*" available in each case. The values of $\sqrt{n}$, with which we are more concerned, are given in column (2·2). Column (3·1) gives the observed standard deviations; dividing these values by the corresponding values of $\sqrt{n}$, we get the standard errors shown in column (3·2). For example, for one-acre units the standard deviation is ·0326; dividing by $\sqrt{n} = 41·70$ we get a standard error of 0·0078.

52. The next column (4·1) shows the estimated proportion (p) under jute together with the corresponding standard error already given in column (3·2). Multiplying by the total area under survey, we get the estimated area under jute with the corresponding standard errors. In this particular case, the area under survey was 1,29,920 acres. Multiplying this by the value of 'p' for 1-acre grids, namely 0·3982, we get 50,565 acres as the estimated area under jute. Multiplying the corresponding standard error ·0078 by the total area 1,29,920, we also get 1013 acres as the standard error of the estimate. The estimated area for 4-acre and 16-acre grids were obtained in the same way and are shown in column (4·2).

53. Let us now compare the results. For 1-acre grids the estimated area is 50,565 acres, and for 4-acre grids 46,901 acres. The difference is therefore 3,664 acres which has been shown in column (5·1). The difference between estimates

obtained from 1-acre and 16-acre units is 8,627 acres ; and from 4-acre and 16-acre grids 4,963 acres as shown in column (5·2).

Sampling error of difference between two estimates

54. I have already explained that in statistics the magnitude of the difference between two estimates as such has no meaning. The significance of the difference can only be decided in comparison with the sampling error of the estimates. We must therefore determine the sampling errors of the difference given in columns (5·1) and (5·2). Without entering into details, I may mention that the standard error of a difference of two estimates is given by the square-root of the sum of the squares of standard errors of the two estimates under comparison. For example, in the case of one-acre units the standard error is 1013 acres, the square of which is 10,26,169 ; the standard error for 4-acre grids is 1741, the square of which is 30,31,081. Adding these two squares we get 40,57,250 ; and extracting the square-root we get 2014 acres which will be the sampling error of the difference between the two estimates if the number of grids in both cases were equal. In the present example the number of grids are however, not equal. Taking this into consideration (that is, using the weighted sum of squares) we get a slightly different value 2261 as shown in the Table (5·3). The sampling errors of the other differences were obtained in the same way and are shown in columns (5·1) and (5·2).

55. We thus find that the difference in the estimates obtained from 1-acre and 4-acre grids is 3664 acres with a sampling error of 2261 acres. The observed difference is therefore about 1·8 times the sampling error and is statistically negligible, as such a difference may easily arise from errors of sampling. We conclude therefore that the estimates obtained from actual sampling surveys with 1-acre and 4-acre grids are in satisfactory agreement.

56. Similar comparative figures are given for the different districts in the same Table (5·3). The difference between different estimates together with corresponding standard errors are shown in each case in columns (5·1) and (5·2). The observed values of '*t*' (that is, the difference divided by the corresponding standard error) are also given within brackets. It will be noticed that (with one exception in the case of the comparison between 1-acre and 4-acre grids in district Pabna) all the observed values of '*t*' are less than 2 showing satisfactory agreement between results obtained from sample surveys with different sizes of sampling units.

57. For convenience of reference the estimated area under jute obtained by different sizes of grids are shown in a consolidated

form in Table (5·4). The values of 't' of differences between these estimates are given in the next Table (5·5). As already noted, it will be seen that in only one case the observed value of 't' is greater than 2. In fact in most cases the observed value of 't' is less than 1.

58. The results obtained from sample surveys actually conducted on the field in 1938 thus show excellent agreement. We conclude therefore that a sample survey properly conducted may be expected to give results within limits of accuracy expected on theoretical grounds. In other words, the results of the sample surveys actually conducted on the field in 1938 conclusively show that the theory of random sampling can be used with success in the present problem.

The size of jute plots

59. I may consider briefly in passing the question of the size of jute plots which was raised in paragraph 4 of Sir Bryce Burt's Note of the 11th October, 1938 (*Proceedings of the Jute Census Committee,* 26th October 1938, p. 13). Table (5·61) and (5·71) show the actual frequency distributions of the size of "plots with jute" and "plots without jute" in two thanas in districts Mymensingh and Rangpur. As judged by the Chi-square test it cannot be asserted that plots with jute are significantly differentiated in size. From the two Tables (5·62) and (5·72) which show the distribution of the percentage under jute in random plots, it appears, however, that in these two thanas a certain proportion of plots occur which have only a fraction under jute.

Number of grids Required to attain given accuracy

60. We may now resume the main line of argument. We have seen that the results of the different sampling experiments are in satisfactory agreement. This does not mean, however, that the same accuracy will be attained with the same number of grids of different sizes. In fact we have seen that the standard deviation or variability decreases as the size of the grid is increased. This shows that it is possible to attain the same accuracy with a lower number of grids of a larger size.

61. I have already explained that the accuracy of an estimate is proportional to $s/\sqrt{n}$ that is, to the standard deviation divided by the square-root of the number of grids on which the estimate is based. It is clear from this formula that, in order to attain the same accuracy with different sizes of grids, the respective values of $\sqrt{n}$ should be proportional to 's' ; in other words, 'n' the number of grids should be proportional to s^2 or the square of the standard deviation (which is known as "variance" in statistical literature).

62. Let us consider an actual example. In Deganga thana the standard deviation for one-acre grids was 0·0860; while the standard deviation for random plots was 0·1339. The square of ·0860 is ·007396, while the square of ·1339 is ·01792921; and the number of grids required of each size to give the same accuracy will be proportional respectively to these two numbers. Dividing ·007396 by ·01792921 we get 0·43 approximately. We find, therefore, that 43 grids of size 1-acre will give a result of the same accuracy as 100 random plots.

63. The actual values of standard deviations are shown in Table (5·8). We may use the variability for random plots, which is highest, as a standard of comparison. The number of grids of different sizes which will be required to give estimates of the same accuracy as 100 random plot were calculated as explained above and are shown in columns (7)—(11) of Table (5·8).

64. The very important question of the cost of collecting information arises at this stage. For example, from the above table we find that 32 grids of size 16-acre will give results of the same accuracy as 54 grids of size 1 acre in Iswarganj (Mymensing). If the cost of collecting information for 32 grids of 16-acre is equal to the cost of collecting information for 54 grids of size one-acre, then it is quite immaterial which size of grid we adopt in practice. If however the cost of collecting 32 grids of 16-acre is greater than the cost of collecting 54 grids of size 1-acre, then obviously it will be economical to adopt 1-acre in preference to 16-acre as our sampling unit.

65. Besides the relation between the variability or standard deviation and the size of the grid (which may be conveniently called the 'variance function') it is therefore also necesssary to study the 'cost function' which gives the relation between the cost of operations per sampling unit and the size of grids. Before taking up this question in the next Section, I may give here a summary of the discussion in Sections 3 and 4.

Summary of conclusions

66. From a detailed analysis of the results of the model sampling experiments conducted in the Laboratory on the basis of the material collected in Deganga thana in 24 Parganas in 1937, as well as of the results of the sampling experiments actually conducted in the field in six thanas in six districts in 1938 we reach the following conclusions :—

(1) The estimated areas under jute obtained by different methods, that is, by using grids of different sizes, are in satisfactory agreement.

(2) The theory of random sampling may, therefore, be used with success in the present problem.

(3) The standard deviation or variability decreases as the size of grid is increased, but proportionately less so than in the case of a binomial distribution.

(4) The manner in which the variability decreases with increasing size of grids, that is, the relation between the variability and the size of grids (which may be called the 'variance function') requires further study by the method of model sampling experiments in the Laboratory.

(5) A knowledge of this relationship (that is, of the variance function) will enable us to find out, for any given size of grid, what will be the number of grids required to attain any desired level of accuracy.

Section 6. Cost Analysis.

67. I shall now briefly consider the cost of the field survey during 1938. It must be remembered, however, that this year the work had to be carried on under very exceptional circumstances when high flooding had already taken place. Expenditure on field work in 1938 must therefore have been higher than what might be expected to be incurred in a normal year during the drier part of the season. The figures for relative cost for different sizes or densities of grids are, however, probably reliable.

68. Table (6·1) shows the number of plots enumerated on the field per net working day with different densities of sampling units per square mile. In every case the number of plots enumerated increases as the density is increased. This is just what is to be expected. With a thin density it is clear that a good deal of time will be spent in travelling from one unit to another.

69. If we have, for example, only one sampling unit in each mauza, the greater part of the time will be taken up in travelling from one mauza to another. On the other hand, when the number of sampling units within each mauza is large, a much greater volume of work will be done. For 16-acre grids, for example, the number of plots enumerated with a density of one grid per square mile is 144, which increases to 168 with a density of 2 grids per square mile, and to 205 with a density of 3 grids. The same feature is observed in the case of one-acre and 4-acre grids. For example, in the case of one-acre grids, the number of plots enumerated is 30 with a density of 2 grids per square mile, which rises to 67 with a density of 10 grids per square mile.

70. In calculating sampling errors we are, however, more concerned with the number of grids rather than with the number

of plots. The next Table (6·2) shows the number of samples enumerated per net working day for different sizes of sampling units, and different densities per square mile.

71. I should mention here that some of the observed results were based on samples of small size. It was therefore considered advisable to give graduated rather than the crude values in Tables (6·1) and (6·2).

72. In cost analysis the manner in which the net working day is utilized is of considerable importance. We may broadly divide the total cost under four heads :—

(*a*) actual time spent in field enumeration ;

(*b*) time spent in miscellaneous preparatory work ;

(*c*) time spent in journeys ;

(*d*) time spent in other ways, namely making arrangements about food, sleep etc.

73. I have attempted a preliminary analysis on this basis and the results are given in Table (6·3). It will be noticed that in complete enumeration the total time spent in field work is 21·6 per cent and is higher than the time spent in enumeration in other cases. The time required for preparatory work is less than 2 per cent, and is naturally much less than the time spent in preparatory work for sample surveys. The time spent in journeys (6·6 per cent) is also appreciably less.

74. It is interesting to observe that the overhead percentage is very nearly 70 in every case. We find then that about 30 per cent or 7 hours per day are actually utilized for productive work; so that no less than 17 hours are consumed in non-productive work.

75. In complete enumeration 22 per cent or over 5 hours per net working day can be utilised in actual field enumeration, while only about 1·6 hours is spent in travelling. In the case of sample surveys only a little over three hours can actually be utilized for field enumeration. In fact the time spent in journeys is roughly the same as the time spent in actual enumeration work.

76. The above analysis clearly shows that the time spent in journeys is as important as time spent in field enumeration in sample surveys. With a small number of units per square mile, it is clear that proportionately more time will be spent in journeys ; while, when the density is large, proportionately more time can be utilized in actual field work. The results given in Tables (6·1) and (6·2) are therefore easily explained.

Section 7. Comparative Efficiency of Grids of Different Sizes.

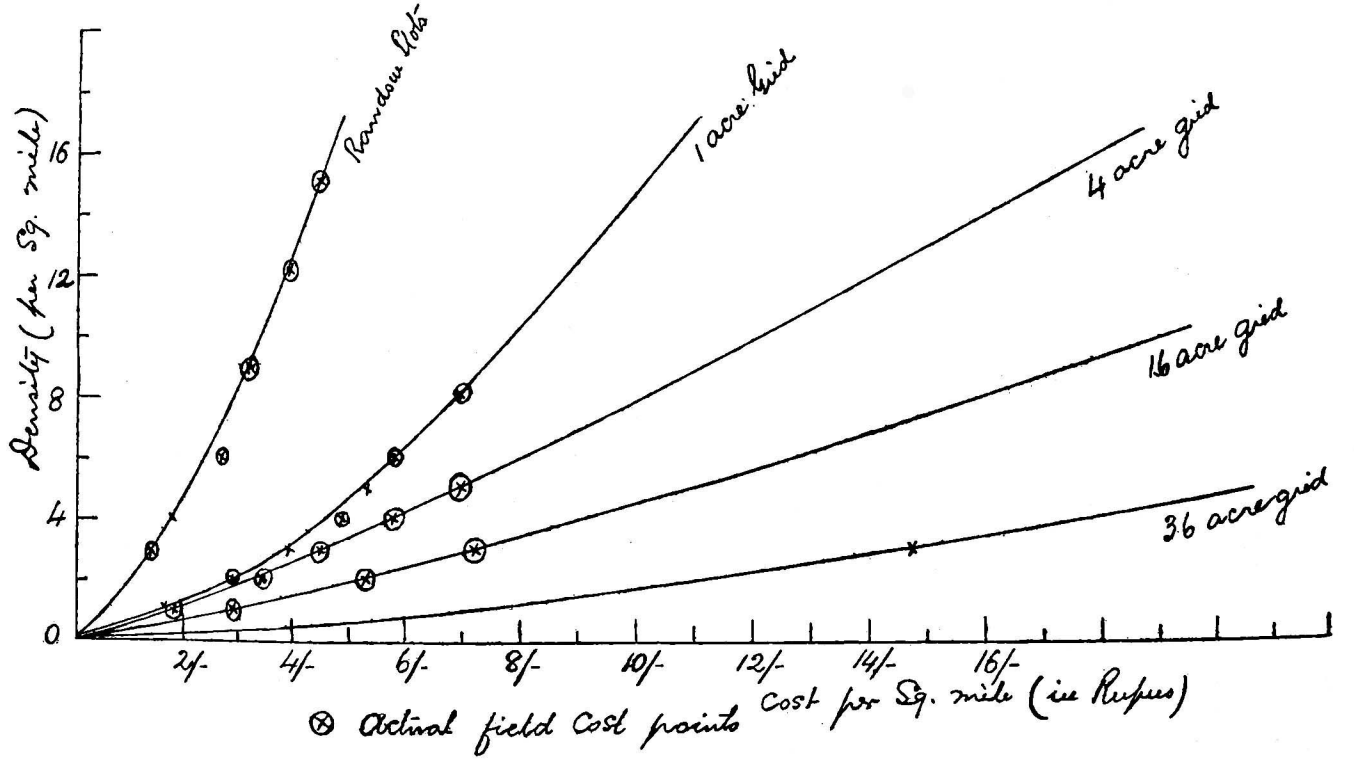
77. We have seen already that the accuracy obtained by the grids of different size depends on the standard deviation as well as the number of grids available. The relation between the standard deviation and the size of grids is given by what I have called the 'variance function'. The number of grids of any given size which can be collected depends, however, on the cost of operation per sampling unit, or on what I have called the 'cost function'. Information for the Laboratory portion of the work for sample surveys can be obtained from laboratory records of model experiments conducted on the basis of data relating to complete enumeration. On the other hand, information regarding the cost of field operations for sample surveys can only be collected by direct field experiments. Unfortunately the available information is very meagre. The question however is so important and it is so essential that further experiments in this matter should be continued that I have thought it advisable to discuss it with the help of such material as happens to be available.

78. For this purpose I have pieced together information partly gathered during the field survey in 1937, partly collected in the Statistical Laboratory during the analysis of the 1937 material, and partly collected this year. The data used are therefore definitely heterogeneous and of varying reliability in different parts. The material also does not refer to any particular district or thana, and in fact is an artificial mixture ; and I am using it purely for purposes of illustration. It must be remembered that, although the figures and results are of the right order, they cannot be used for preparing estimates of the cost of a sample survey on a provincial scale.

Cost per sampling unit

79. Table (7·1) shows (for purposes of illustration) the estimated cost in rupees of collecting information for each sampling unit of different sizes. Column (1·1) gives the size of the sampling unit, and (1·2) the density or number of sampling units per square mile. Col. (2·1) gives the estimated cost for the laboratory portion of the work, and col. (2·2) the corresponding cost for the field portion of the work. Adding these two together we get the total cost in rupees for each sampling unit or grid shown in col. (2·3).

Graph Showing actual Field-Cost Points



80. These figures are supposed to include the cost of ordinary inspection and supervision and a portion of miscellaneous charges. It will be realized, however, that it is not possible to incorporate actual overhead charges (such as superior direction and supervision, house-rent and other expenses at headquarters etc) in a table like this, as such overhead charges are largely of a fixed nature, and depend on the scale on which the work is organized. The figures given may therefore be considered to represent what may be called the working operations exclusive of overhead. I have already explained, and this point cannot be over emphasized, that the figures given in Table (7·1) are based on very heterogeneous material and cannot be used for preparing detailed estimates. In fact in many places the figures given were actually obtained by extrapolation and are therefore of doubtful value.

81. The accompanying graph shows the values for which actual field figures are available. It will be noticed that the observed values are small in number ; they are also of varying accuracy. For purposes of illustration I have, however, drawn smooth curves from which the figures given in Table (7·1) have been obtained.

Cost per square mile

82. For our present purpose it is more convenient to convert the figures into cost per square mile. This will naturally depend on the density or the number of grids in each square mile. In Table (7·1), for example, for 1-acre grids we find that the cost is Rs. 1,594 per grid when they are distributed with an average density of one grid per square mile. The cost per sample naturally decreases as the density is increased ; and we find that the cost per sample is Rs. 0·87 when the density is 8 grids per square mile. Turning to column (3·3) in the same table we find that the cost per square mile is Rs. 1,594 which is just the same as the cost per sample with a density of the one grid per square mile. When the density is increased to 8 per square mile, we have 8 grids altogether and the cost rises to Rs. 6·96 per sq. mile.

83. One point is worth noting. With increasing density the cost in the Laboratory portion of the work decreases much more slowly than in the field portion of the work. This is of course just what is to be expected ; since the locating of random points, the construction of grids, the listing of plots, the preparation of crop schedules, addition and checking etc, depend almost directly on the total number of plots covered, as the saving possible in turning over maps, changing computation sheets etc. is on the whole small. In the field portion of the work, as I have already pointed out, the decrease in expenditure with increasing density is very appreciable owing to the saving in the time of locating the sample plots, and in moving from one grid to another.

Density at different levels of expenditure

84. I shall now discuss how Table (7·1) can be used in practice. The question of total expenditure has to be now taken into consideration. Here also it will be convenient if we consider the total cost per square mile. For example, suppose we decide on spending Rs. 3/-per square mile (which will amount to Rs. 1,65,000 for 55,000 square miles, the total area proposed to be covered in a full scale provincial survey). From the graph or by numerical interpolation in Table (7·1), we find that with this expenditure we can use random plots with a density of 7·9 per square mile, or 1-acre grids with a density of 2·1 per sq. mile, or 4-acre grids of density of 1·7 per sq, mile, or 16-acre grids of density of 0·64 per sq. mile. Similar values for other rates of expenditure per square miles are given in Table (7·2).

85. The important point to be noticed is that the cost for different densities of grids is a relevant factor in the present connexion. Because of the decrease in cost with increasing density of the grids, the total cost decreases as the density is increased. In other words, with any given size of grid, and with given total expenditure, the actual number of grids which can be enumerated depends on the density of grids per square mile. This is why the construction of a cost function showing the cost per square mile for different densities per square mile is essential in our present problem.

86. I may now proceed with the main argument. Table (7·2) gives us then the number of samples per square mile which we can use in practice with a given expenditure per square mile. This table then gives us for different sizes of grids, and for different rates of expenditure, the number of samples available (n) per square mile. We know, however, that the accuracy of the sampling experiment depends on $1/\sqrt{n}$. It is convenient therefore to obtain the corresponding values of $1/\sqrt{n}$ which are shown in Table (7·3.)

87. I should like to explain at this stage that the cost function may be different in different districts. We have very little information on this point ; but this is a question which it will be necessary to investigate in detail in future. In the meantime, as I have already explained, I am using Tables (7·2) and (7·3) as typical tables for purposes of illustration.

Sampling error per square mile

88. If we now multiply the value of $1/\sqrt{n}$ given in Tables (7·3) by the corresponding values of 's', it is clear that we shall obtain the effective sampling error per square mile with any assigned rate of expenditure per square mile. The standard deviations for different sizes, we know, differ from district to

district. Using relevant figures, we can however obtain the effective sampling error per square mile for each district.

89. For example for Deganga thana we find that the standard deviation for random plots was 0·131. Multiplying this number by $1/\sqrt{n}$ given in col. (1) of Table (7·3) we obtain the sample error per square mile for random plots in col. (2) under Deganga in Table (7·4). In the same way the sampling error for other sizes of sampling units and other districts were obtained and are shown in Table (7·4).

Economic size of grids

90. These values of sampling error per square mile will now enable us to decide which size of grid is most economical. For example, in thana Deganga we find that the sampling error will be least with grids of size 16-acre at practically all levels of expenditure. In Deganga 16-acre grids would be thus the most efficient. (I must however again give a note of warning at this stage. In the case of Deganga thana no field work was actually done with 16-acre grids ; and the figures given here are purely hypothetical so far as this particular size is concerned).

91. In Mymensingh, Rangpur, Rajshahi and Tipperah we find that random plots will give the lowest sampling error or the highest accuracy at all levels of expenditure. In Pabna, on the other hand, 16-acre grids appear to be more efficient and next come random plots. As already pointed out, the cost figures for 16-acre grids are based on a very small number of grids actually surveyed on the field. It is not possible therefore to attach much importance to the two isolated results in two districts where the 16-acre grids come out to be more efficient.

92. On the whole, we find that one-acre and four-acre grids are more efficient than 16-acre grids. Also, almost invariably, random plots appear to be more efficient than grids of larger size.

93. The above discussion is based on Table (7·1) which, as I have already explained, is somewhat hypothetical in nature. The need of constructing reliable tables of the present kind is however quite clear. It is therefore essential that we should conduct, at the next stage of the Scheme, carefully designed experiments for gathering information regarding the cost, not only for different sizes of grids, but also for different densities of grids per square mile.

Percentage variability per square mile

94. Instead of working with actual sampling error per square mile, we may also work with the percentage variability per square mile. This is obtained by dividing the sampling error per square

mile by the corresponding value of 'p' or the proportion under Jute and expressing the result as a percentage.

95. The percentage variabilities calculated as explained above are given in Table (7·5) for different sizes of grids and for different levels of expenditure. It will be noticed that the percentage variability with a given scale of expenditure differs very widely in different districts. This is of course just what is to be expected in view of the fact that the values of 'p' or the proportion under jute varies widely in different districts.

96. The results given in terms of the percentage variability per square mile are of course parallel to those obtained in terms of standard error per square mile. For example, in Mymensingh, the random plot is easily the most economical size of the sampling unit in the sense that at every level of expenditure the percentage variability will be least for random plots.

Importance of a proper choice of grids

97. It will be useful at this stage to consider what will be the difference in cost in using different sizes of grids to attain any given level of accuracy or percentage variability. Interpolating in Table (7·5), or directly from the graph, we can obtain the cost per square mile which would be incurred for different sizes of grids to attain any assigned level of percentage variability. These values are shown in Table (7·6).

98. Let us consider the position in Mymensingh for example. To attain say a level of accuracy of 50 per cent per square mile we find that the cost will be Rs. 2·9 with random plots, Rs. 4·7 with one-acre grids, Rs. 4·4 with four-acre grids and Rs. 6·1 with sixteen-acre grids. A glance at the other figures given in the same table will show that the differences are in most cases enormous. Table (7·6) bring out most forcibly how important is the question of a proper choice of the size and density of grids. We find that by a wrong choice of the size of grids the cost may easily be doubled or even trebled.

99. I may also mention at this stage without entering into technical details that the wide variation in the intensity of cultivation or the proportion under jute in different thanas introduces a complication in the sampling programme. Theoretical considerations show that the number of sampling units to be alloted to the different thanas or zones should be determined according to the intensity of cultivation or the values of 'p' (the proportion under jute). In actual practice this means that, for efficient sampling, the density of grids per square mile will have to be different in different districts depending on the intensity of cultivation. This is another reason why it is absolutely

necessary to gather information regarding the cost of field work for different densities of sampling units.

100. So far as the cost function is concerned, the chief conclusions may be now summarized :—

(1) With any given rate of expenditure, the effective accuracy of the estimate depends on both the size as well as the density or number of grids per square mile.

(2) The available evidence suggests that on the whole sampling units or grids of smaller size are more efficient or economical than grids of larger size in the sense that a higher accuracy can be attained with the same expenditure.

(3) It is most important that a proper choice should be made of the size (and density) of grids. The cost may easily be doubled or trebled by a wrong choice.

(4) In order to determine the best size of grids it is essential that accurate information should be obtained regarding the cost of operations not only for different sizes but also for different densities of grids.

(5) It is possible that the cost function, that is, the relation between the cost of operations and the size and densities of grids, will be different in different districts. I do not consider it likely that such differences will be large, but this is a possibility which must be kept in mind in framing our programme.

(6) In case the cost function is found to be different in different districts, it may follow that we shall have to use different sizes of grids in different districts or zones.

(7) We know however that the intensity of cultivation differs very widely in different zones. It is therefore necessary, in any case, to use different densities of grids in different zones in order to attain the highest accuracy in the estimate. This is another reason why the cost of operations must be determined for different densities per square mile.

Section 8. General Observations

I have no time to discuss the results in detail. I shall therefore conclude this report by a few observations of a general

nature. In the scheme for the 1938 survey which I submitted on the 26th June 1938 I had clearly explained (printed *Proceedings of the First Meeting of the Jute Census Committee* held on the 6th July 1938, pp. 32-33) that a complete census was impracticable in the immediate future. This was fully corroborated in my "Statistical Report on the Experimental Crop Census of 1937" submitted in August 1937. I again emphasized this point in my Note dated 24th October 1938 from which a few extracts will not be out of place.

Impracticability of a Complete Census

"The 1937 Survey has shown that the organization of a complete census in one year will require a very large staff of the order of at least five or six thousand men, and will involve an expenditure of the order of twelve or fifteen lakhs of rupees. Untill the workers can be properly trained, and suitable arrangements can be made for adequate control and inspection of the primary work, the results are likely to be thoroughly unreliable, the estimated accuracy being of the order of 50 or 60 per cent for individual thanas, and considerably more for individual mauzas.

"A Census covering one district or a group of districts will be unreliable, and will also be useless for administrative purposes as it will not be possible, to compare or coordinate the data for different years owing to marked seasonal fluctuations.

A sample survey the only possible line of advance

"In this situation, a sample survey, carried on from year to year is the only possible line of advance in the immediate future. There are many advantages in this plan :—

(i) It will require a staff of, say, five or six hundred men (against so many thousands in a complete census) which will reduce very appreciably the difficulties of organization and inspection.

(ii) In an extended programme it will be possible to give proper training to the workers ; and also to weed out unreliable enumerators. This will enable the reliability of the results being improved, and the cost of the survey reduced progressively from year to year.

(iii) The expenditure involved will be comparatively small being of the order of one or two lakhs of rupees per year.

(iv) The plan is flexible, and will allow the work being expanded *pari passu* with the increase in the number of trained workers. In this way, it will be possible, if desired, to undertake a complete crop census of the whole province after the necessary organization has been built up." *(Proceedings, Jute Census Committee, 26th October 1938,* pp. 31ff).

Experience of U. S. A.

102. In the same note I quoted from an authoritative report of a Statistical Conference held in the United States in July 1936 under the auspices of the United States Department of Agriculture and attended by about 60 agricultural economists and statisticians, in which it was unanimously recommended that a Sample Survey should be conducted every year.

Objects of the 1938 Survey

103. In framing the Scheme for the 1938 survey I had definitely stated (*Proceedings, Jute Census Committee,* 6th July, 1938, p. 33) :—

"The object of the present Scheme may be thus broadly defined as two-fold :—

(i) to develop and standardize the technical methods for a Sample Survey ; and *(ii)* Secondly, to build up the necessary human agency to carry it out in practice."

Results of the present Survey

104. In judging the results of the present Survey it is therefore necessary to concentrate on these two points. The work done this year shows conclusively that a sample survey is practicable and is likely to give results of reasonable accuracy. On the more technical side we have found that for further progress detailed researches are necessary on two points :—

(i) The study of the 'variance function', that is, the relation between the variability and the size of grids. As we now possess results of complete enumeration for about 500 square miles it is fortunately possible to study this question by model sampling experiments in the Laboratory.

(ii) It is also necessary to study the cost function, that is, the cost of operations for different sizes and densities of grids. This can only be done by direct experiments on the field.

The programme for 1939

105. The proposed programme for 1939 includes both these items. In addition, it has been thought advisable to include complete enumeration of about 1000 square miles. This would be useful in furnishing further material for the study of the variance function. It will be noticed therefore that the programme for 1939 follows logically from the results obtained during the 1938 Survey and discussed in this report.

Problems of Organization

106. The question of organization is, of course, very important. As the time at my disposal is very short, here also I shall make only a few general observations.

Continuity of work essential for success

107. I have been working on the present Scheme for about 16 months, and I have been realizing more and more the importance of continuity of work. I hope the Jute Census Committee as well as the Indian Central Jute Committee will take necessary steps to ensure this by such means as they consider suitable.

The need of a nuclear staff

108. The next important point I think is the question of a nuclear or a semi-permanent staff for the Scheme. I have given this matter careful consideration, and I am of opinion that the most economic way of arranging this will be, as originally proposed in my note of the 26th June 1938, to employ a staff of, say 80 or 90 men who will be engaged on the Scheme throughout the year. Most of them will work as inspecting officers for about four months during the actual field survey ; during the remaining eight months of the year they will be engaged in (*a*) statistical analysis of the material collected in the field, (*b*) model sampling experiments, and (c) preparation of grids and other preliminary work for the field survey in the succeeding year.

109. The advantages of such a semi-permanent staff will be four-fold. The work will be better done. These men will know that unless their work is done with accuracy they will run the risk of losing their jobs. The inspection of the field work will therefore be done with efficiency and with a sense of responsibility. This is the only way in which there is any hope of improving the quality of the primary enumeration. Secondly, with continuous training the output of work will increase with consequent reduction in cost. Thirdly, the scale of salaries will be lower as the men will be employed on a whole-time basis. And

finally, as the load of work will be distributed more uniformly over the whole year, supervision will be easier and the general efficiency of the work will increase.

Type of primary enumerators

110. A third organizational question which requires careful consideration is the type of men to be employed for primary enumeration. My feeling has always been that ultimately the best policy will be to empoly local enumerators who will be resident in the thanas or zones in which they will work. This should also be cheaper. Efficiency of work should gradually increase in this plan as the men become familiar with the ground which they will cover in their work.

111. At the same time, I admit that employing trained *amins* has also certain advantages. Being familiar with cadastral maps and settlement operations, the *amins* as a class may be expected to do the work more quickly and more accurately than other men. It is likely, however that the question of inspection and supervision will be more difficult, as the *amins* may require more careful watching. I would suggest that an attempt should be made to study this question by a carefully designed experiment in which the output as well as the accuracy of "*amins* versus local men" would be investigated experimentally under controlled conditions.

The question of restriction of Jute Area

112. In sanctioning the scheme the Government of Bengal requested the Committee "to keep prominently in view the necessity of co-ordinating the experimental work to the requirements of a possible restriction policy particularly as to how a quota could be allocated over the whole area." (*Proceedings*, 6th July, 1938, p. 13).

113. The time has not come to discuss this question in detail. I may, however, make one or two preliminary remarks purely from a statistical point of view. (I need scarcely mention I am neither competent nor have I any desire to give any opinion regarding the administrative aspects of the question.) Owing to the unreliability of the primary enumeration, I think it will be very difficult to bring into effect any policy of restriction relating to individual plots.

Zonal restriction

114. From the statistical point of view, a more convenient plan will be to prohibit completely the cultivation of jute in a number of compact blocks. For example, if the whole

province is divided into a large number of Zones (or Unions or mouzas are used for this purpose) it is possible to restrict cultivation *completely* in the required number of zones (or Unions or mouzas) which may be selected at random either within the province as a whole or within particular districts or subdivisions in case it is desired to give any weightage. In this plan, no jute would be allowed to be grown within restricted zones. Detection of infringements should then be quite easy.

The Question of compensation

115. Such zonal restriction will of course raise the question of compensation. This is, however, inherent in any policy of restriction. The problem has certain interesting statistical aspects which deserve consideration. I have no time, nor will it serve any usefull purpose at this stage, to discuss this question in greater detail.

Accurate estimates fundamental

116. In any plan of restriction it is clear, however, that the question of accurate estimates of the acreage under jute is fundamental. As a statistical worker I am not concerned with the question of policy ; but the improvement of the accuracy of the estimates is essentially a statistical problem, and I submit that the wisest policy will be to leave the statistical details to technicians.

P. C. MAHALANOBIS.

26th December, 1938.

TABLE I.

Statement of Field Work completed during August-October, 1938.

Districts.	Thanas.	Complete Enumeration.				16-acre Samples.		4-acre Samples.		1-acre Samples		Random Plots	
		No. of Mouzas.	No. of plots surveyed.	Approximate area in acres.	Approximate area in sq. miles.	Samples.	Plots.	Samples.	Plots.	Samples.	Plots.	Samples.	Plots.
(1·1)	(1·2)	(2·1)	(2·2)	(2·3)	(2·4)	(3·1)	(3·2)	(4·1)	4·2)	(5·1)	(5·2)	(6·1)	(6·2)
Dacca ...	Kaliganj ...	94	54,382	50,295	78·6	...	...	...	...	152	816	...	...
Murshidabad ...	Beldanga ...	23	41,388	13,911	21·7	11	674	78	1,562	289	2,240	...	...
Mymensingh ...	Iswarganj ...	348	145,557	77,675	121·4	77	3,199	456	6,489	2,060	11,577	882	882
Nadia ...	Nakashipara ...	64	53,555	34,872	54·5	...	...	...	...	57	247	...	...
Pabna ...	Sara ...	36	23,890	20,621	32·2	9	356	240	2,911	687	4,287	367	367
Rajshahi ...	Badalgachi ...	107	45,201	22,127	34·6	60	2,729	...	...	361	2,462	371	371
Rangpur ...	Domar ...	14	50,278	14,781	23·1	127	9,323	256	5,568	1,057	8,001	329	329
Tipperah ...	Laksham ...	138	64,388	30,573	47·8	44	2,675	191	3,556	1,676	10,039	591	591
All Districts ...	.....	824	478,639	264,855	413·9	328	18,956	1,221	20,086	6,339	39,669	2,540	2,540

TABLE 2(M/1).

District—MYMENSINGH. Thana—ISWARGANJ.

JUTE.

Method of enumeration compared.		Total Plots.		Actual Discrepancies.		Sum of Discrepancies.		Discrepancies as percentages of A.	
A	B	A	B	Positive.	Negative.	Algebraic.	Absolute.	Algebraic.	Absolute.
¼ E.	16 acre ...	808·78	851·79	185·59	228·60	−43·01	414·19	−5·31	51·21
¼ E.	4 acre ...	1,873·54	1,848·00	425·90	400·36	25·54	826·26	1·36	44·10
¼ E.	1 acre ...	2,961·44	2,956·28	660·96	655·80	5·16	1,316·76	0·17	44·46
¼ E.	R. P. ...	136·06	134·16	50·31	48·41	1·90	98·72	1·40	72·56
6 acre	4 acre ...	151·43	144·34	58·02	50·93	7·09	108·95	4·68	71·95
6 acre	1 acre ...	70·92	74·91	25·02	29·01	3·99	54·03	5·63	76·18
4 acre	1 acre ...	500·89	551·96	151·32	202·39	−51·07	353·71	−10·20	70·62

TABLE 2(M/1)—*Contd.*

AUS.

Method of enumeration compared.		Total Plots.		Actual Discrepancies.		Sum of Discrepancies.		Discrepancies as percentages of A.	
A	B	A	B	Positive.	Negative.	Algebraic.	Absolute.	Algebraic.	Absolute.
C. E.	16 acre ...	365·29	308·48	247·23	190·42	56·81	437·65	15·55	119·81
C. E.	4 acre ...	763·18	624·40	440·07	301·29	138·78	741·36	18·18	97·14
C. E.	1 acre ...	1,273·92	1,016·87	703·57	446·52	257·05	1,150·09	20·18	90·28
C. E.	R. P. ...	47·29	35·04	35·79	23·54	12·25	59·33	25·90	125·46
16 acre	4 acre ...	94·91	90·53	48·09	43·71	4·38	91·80	4·62	96·72
16 acre	1 acre ...	47·54	45·83	31·90	30·19	1·71	62·09	3·60	130·61
4 acre	1 acre ...	238·23	239·04	113·92	114·73	−0·81	228·65	−0·34	95·98
				AMAN.					
C. E.	16 acre ...	1,194·33	1,273·79	238·06	317·52	−79·46	555·58	−6·65	46·52

C. E.	4 acre ...	2,056·54	2,179·79	416·04	539·29	−123·25	955·33	−5·99	46·45
C. E.	1 acre ...	3,332·56	3,628·14	672·59	968·17	−295·58	1,640·76	−8·87	49·23
C. E.	R. P. ...	199·16	218·55	47·08	66·47	−19·39	113·55	−9·74	57·01
16 acre	4 acre ...	413·57	406·06	60·69	53·18	7·51	113·87	1·82	27·53
16 acre	1 acre ...	194·95	197·60	26·45	29·10	−2·65	55·55	−1·36	28·49
4 acre	1 acre ...	1,070·33	1,048·63	195·82	174·12	21·70	369·94	2·03	34·56

OTHER CROPS.

C. E.	16 acre ...	605·60	539·94	200·60	134·94	65·66	335·54	10·84	55·40
C E.	4 acre ...	966·74	1007·81	239·37	280·44	−41·07	519·81	−4·25	53·77
C. E.	1 acre ...	1740·08	1706·71	457·50	424·13	33·37	881·63	1·92	50·67
C. E.	R. P. ...	88·49	83·25	28·31	23·07	5·24	51·38	5·92	58·06
16 acre	4 acre ...	131·09	150·07	23·17	42·15	−18·98	65·32	−14·48	49·83
16 acre	1 acre ...	78·59	72·66	16·44	11·51	4·93	27·95	6·27	35·56
4 acre	1 acre ...	389·55	359·37	105·89	75·71	30·18	181·60	7·75	46·62

TABLE 2(M/2).

Discrepancies between 16 acre grid and Complete Enumeration, 1938.

District—Mymensingh. Thana—Iswarganj.

JUTE.

Serial No. of Union.	Total Plots.		Actual Discrepancies.		Sum of Discrepancies.		Discrepancies as percentage of Complete Enumeration.	
	Complete Enumeration.	16 acre Grid.	Positive.	Negative.	Algebraic.	Absolute.	Algebraic.	Absolute.
(1)	(2·1)	(2·2)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)
2	79·75	84·48	26·17	30·90	−4·73	57·07	−5·93	71·56
8	102·23	109·43	25·31	32·51	−7·20	57·82	−7·04	56·56
9	195·36	201·46	31·18	37·28	−6·10	68·46	−3·12	35·04
10	224·34	245·27	47·58	68·51	−20·93	116·09	−9·33	51·75
18	116·51	132·33	25·42	41·24	−15·82	66·66	−13·58	57·21
20	90·59	78·82	29·93	18·16	11·77	48·09	12·99	55·08
TOTAL ...	808·78	851·79	185·59	228·60	−43·01	414·19	−5·31	51·21
AUS.								
2	80·19	66·83	55·03	41·67	13·36	96·70	16·66	120·56
8	63·42	46·75	38·33	21·66	16·67	59·99	26·28	94·59
9	51·51	45·10	33·35	26·94	6·41	60·29	12·44	117·04
10	108·93	96·81	72·86	60·74	12·12	133·60	11·13	122·65
18	33·33	21·66	29·50	17·83	11·67	47·33	35·01	142·00
20	27·91	31·33	18·16	21·58	−3·42	39·74	−12·25	142·39
TOTAL ...	365·29	308·48	247·23	190·42	56·81	437·65	15·55	119·81

TABLE 2(M/3)

Discrepancies between 16 acre grid and Complete Enumeration, 1938.

District—Mymensingh. Thana—Iswarganj.

AMAN.

Serial No. of Union	Total Plots.		Actual Discrepancies.		Sum of Discrepancies.		Discrepancies as percentages of Complete Enumeration.	
	Complete Enumeration.	16 acre Grid.	Positive.	Negative.	Algebraic.	Absolute.	Algebraic.	Absolute.
(1)	(2·1)	(2·2)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)
2	142·98	177·86	46·98	81·86	−34·88	128·84	−24·40	19·11
8	177·43	203·57	24·51	50·65	−26·14	75·16	−14·73	42·36
9	390·86	404·77	32·67	46·58	−13·91	79·25	− 3·56	20·28
10	263·65	262·41	79·83	78·59	1·24	158·42	0·47	60·09
18	135·33	130·66	36·58	31·91	4·67	68·49	3·45	50·61
20	84·08	94·52	17·49	27·93	−10·44	45·42	−12·42	54·02
TOTAL ..	1194·33	1273·79	238·06	317·52	−79·46	555·58	6·65	46·52
OTHER CROPS.								
2	130·08	103·83	60·33	34·08	26·25	94·41	20·18	72·58
8	60·92	44·25	27·76	11·09	16·67	38·85	27·36	63·77
9	139·27	125·57	31·93	18·33	13·60	50·26	9·76	36·09
10	159·08	151·51	53·50	45·93	7·57	99·43	4·76	62·50
18	34·83	35·35	12·91	13·43	−0·52	26·34	−1·49	75·62
30	81·42	79·33	14·17	12·08	2·09	26·25	2·57	32·24
TOTAL ...	605·60	539·94	200·60	134·94	65·66	335·54	10·84	55·40

TABLE 2(M/3).

Discrepancies between 4-acre grid and Complete Enumeration, 1938 Survey.

District—Mymensingh Thana—Iswarganj.

JUTE

Serial No. of Unions.	Total Plots.		Actual Discrepancies.		Sum of Discrepancies.		Discrepancies as percentages of Complete Enumeration.	
	Complete Enumeration.	4-acre Grid.	Positive.	Negative.	Algebraic.	Absolute.	Algebraic.	Absolute.
(1)	(2·1)	(2·2)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)
2	89·62	111·85	22·34	44·57	−22·23	66·91	−24·80	74·66
6	117·00	105·40	31·50	19·90	11·60	51·40	9·91	43·93
7	172·34	195·94	25·42	49·02	−23·60	74·44	−13·69	43·19
8	274·42	259·97	67·52	53·07	14·45	120·59	5·26	43·94
9	159·92	170·49	35·35	45·92	−10·57	81·27	− 6·61	50·82
10	168·30	155·26	64·04	51·00	13·04	115·04	7·75	68·35
15	105·74	97·24	24·59	16·09	8·50	40·68	8·04	38·47
16	93·36	94·22	14·57	15·43	0·86	30·00	0·92	32·13
17	436·49	408·33	84·48	56·32	28·16	140·80	6·45	32·26
18	135·83	129·44	24·41	18·02	6·39	42·43	4·70	31·24
20	120·52	119·86	31·68	31·02	0·66	62·70	0·55	52·02
TOTAL ...	1,873·54	1,848·00	425·90	400·36	25·54	826·26	1·36	44·10

2	89·16	82·84	45·32	39·00	6·32	84·32	7·09	94·57
6	60·00	49·94	27·33	17·27	10·06	44·60	16·77	74·33
7	64·10	51·18	42·35	29·43	12·92	71·78	20·16	111·98
8	142·41	122·86	74·81	55·26	19·55	130·07	13·73	91·33
9	54·75	51·84	30·92	28·01	2·91	58·93	5·32	107·63
10	103·60	77·93	61·52	35·85	25·67	97·37	24·78	93·99
15	42·72	29·94	25·73	12·95	12·78	38·68	29·92	90·54
16	35·11	30·07	18·89	13·85	5·04	32·74	14·35	93·25
17	78·99	57·33	55·91	34·25	21·66	90·16	27·42	114·14
18	27·68	31·73	14·38	18·43	−4·05	32·81	−14·63	118·53
20	64·66	38·74	42·91	16·99	25·92	59·90	40·09	92·64
TOTAL ...	763·18	624·40	440·07	301·29	138·78	741·36	18·18	97·14

TABLE 2(M/3).

Discrepancies between 4-acre grid and Complete Enumeration, 1938 Survey.

District—Mymensingh Thana—Iswarganj.

AMAN.

Serial No. of Unions.	Total Plots.		Actual Discrepancies.		Sum of Discrepancies.		Discrepancies as percentages of Complete Enumeration.	
	Complete Enumeration.	4-acre Grid.	Positive.	Negative.	Algebraic.	Absolute.	Algebraic.	Absolute.
(1)	(2·1)	(2·2)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)
2	240·56	220·88	62·39	42·71	19·68	105·10	8·18	43·69
6	134·00	151·09	18·00	35·09	−17·09	53·09	−12·75	39·62
7	149·27	141·45	50·93	43·11	7·82	94·04	5·23	63·00
8	341·59	354·20	63·34	75·95	−12·61	139·29	− 3·69	40·78
9	276·76	282·32	49·36	54·92	− 5·56	104·28	− 2·01	37·68
10	170·26	210·11	42·76	82·61	−39·85	125·37	−23·40	73·63
15	109·10	124·54	19·45	34·89	−15·44	54·34	−14·15	49·81
16	86·69	90·45	13·60	17·36	− 3·76	30·96	− 4·34	35·71
17	300·85	336·09	51·25	86·49	−35·24	137·74	−11·71	45·78
18	143·66	143·83	19·57	19·74	− 0·17	39·31	− 0·12	27·36
20	103·80	124·83	25·39	46·42	−21·03	71·81	−20·26	69·18
TOTAL ...	2,056·54	2,179·79	416·04	539·29	−123·25	955·33	− 5·99	46·45

Other Crops.

2	135·66	139·43	28·41	32·18	−3·77	60·59	− 2·78	44·66
6	45·00	49·57	13·34	17·91	−4·57	31·25	−10·16	69·44
7	88·29	85·43	31·44	28·58	2·86	60·02	3·24	67·98
8	118·58	139·97	21·26	42·65	−21·39	63·91	−18·04	53·90
9	107·57	94·35	29·41	16·19	13·22	45·60	12·29	42·39
10	125·84	124·70	29·54	28·40	1·14	57·94	0·90	46·04
15	64·44	70·28	13·69	19·53	−5·84	33·22	− 9·06	51·55
16	51·84	52·26	10·43	10·85	−0·42	21·28	− 0·81	41·05
17	131·67	146·25	37·25	51·83	−14·58	89·08	−11·07	67·65
18	46·83	49·00	11·75	13·92	−2·17	25·67	− 4·63	54·82
20	51·02	56·57	12·85	18·40	−5·55	31·25	−10·88	61·25
Total ...	966·74	1007·81	239·37	280·44	−41·07	519·81	− 4·25	53·77

TABLE 2(M/4)..

Discrepancies between 1-acre grid and Complete Enumeration, 1938.

District—Mymensingh. Thana—Iswarganj.

JUTE.

Serial No. of Unions.	Total Plots.		Actual Discrepancies.		Sum of Discrepancies.		Discrepancies as percentages of Complete Enumeration.	
	Complete Enumeration.	1-acre Grid.	Positive.	Negative.	Algebraic.	Absolute.	Algebraic	Absolute
(1)	(2·1)	(2·2)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)
2	111·25	113·68	34·16	36·59	−2·43	70·75	−2·18	63·60
6	178·02	176·50	47·02	45·50	1·52	92·52	0·85	51·97
7	283·35	252·67	53·26	22·58	30·68	75·84	10·83	26·76
8	232·61	204·65	65·87	37·91	27·96	103·78	12·02	44·61
9	181·12	252·01	20·90	91·79	−70·89	112·69	−39·14	62·22
10	216·02	193·24	72·77	49·99	22·78	122·76	10·55	56·83
12	300·76	297·46	76·56	73·26	3·30	149·82	1·10	49·81
15	234·08	237·23	37·25	40·40	−3·15	77·65	−1·34	33·17
16	263·93	272·30	51·30	59·67	−8·37	110·97	−3·17	42·04
17	346·25	336·75	73·17	63·67	9·50	136·84	2·74	39·52
18	242·58	251·69	39·81	48·92	−9·11	88·73	−3·76	36·58
19	166·35	166·09	37·43	37·17	0·26	74·60	0·16	44·84
20	205·12	202·01	51·46	48·35	3·11	99·81	1·52	48·66
Total	2961·44	2956·28	660·96	655·80	5·16	1316·76	0·17	44·46

2	133·59	115·48	64·19	46·08	18·11	110·27	13·56	82·54
6	82·41	64·94	47·82	30·35	17·47	78·17	21·20	94·85
7	109·07	66·42	74·07	31·42	42·65	105·49	39·10	96·72
8	100·40	95·92	50·24	45·76	4·48	96·00	4·46	95·62
9	40·67	31·83	27·18	18·34	8·84	45·52	21·74	111·92
10	123·31	98·98	71·65	47·32	24·33	118·97	19·73	96·48
12	129·42	77·49	90·68	38·75	51·93	129·43	40·12	100·01
15	110·40	86·70	52·99	29·29	23·70	82·28	21·47	74·53
16	69·67	64·00	39·84	34·17	5·67	74·01	8·14	106·23
17	97·09	96·66	42·43	42·00	0·43	84·43	0·44	86·96
18	65·94	58·15	36·03	28·24	7·79	64·27	11·81	97·47
19	102·44	86·29	41·27	25·12	16·15	66·39	15·76	64·81
20	109·51	74·01	65·18	29·68	35·50	94·86	32·42	86·62
'otal ...	1273·92	1016·87	703·57	446·52	257·05	1150·09	20·18	90·28

TABLE 2(M/4.)

Discrepancies between 1-acre grid and Complete Enumeration, 1938.

District—Mymensingh. Thana—Iswarganj.

AMAN.

Serial No. of Unions.	Total Plots.		Actual Discrepancies.		Sum of Discrepancies.		Discrepancies as percentages of Complete Enumeration.	
	Complete Enumeration.	1-acre Grid.	Positive.	Negative.	Algebraic.	Absolute.	Algebraic.	Absolute.
(1)	(2·1)	(2·2)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)
2	236·74	270·91	46·08	80·25	−34·17	126·33	−14·43	53·36
6	218·25	217·73	50·92	50·40	0·52	101·32	0·24	46·42
7	252·84	339·01	80·75	166·92	−86·17	247·67	−34·08	97·96
8	295·43	316·32	43·53	64·42	−20·89	107·95	−7·07	36·54
9	362·00	319·69	86·26	43·95	42·31	130·21	11·69	95·97
10	163·23	231·35	43·74	111·86	−68·12	155·60	−41·73	95·33
12	190·24	262·88	43·65	116·29	−72·64	159·94	−38·18	84·07
15	257·61	265·82	43·98	52·19	−8·21	96·17	−3·19	37·33
16	258·02	249·32	58·32	49·62	8·70	107·94	3·37	41·83
17	376·77	386·93	57·51	67·67	−10·16	125·18	−2·70	33·22
18	267·58	271·50	42·25	46·17	−3·92	88·42	−1·46	33·04
19	242·84	257·03	34·18	48·37	−14·19	82·55	−5·84	33·99
20	211·01	239·65	41·42	70·06	−28·64	111·48	−13·57	52·83
Total	3332·56	3628·14	672·59	968·17	−295·58	1640·76	−8·87	49·23

2	165·42	146·93	46·50	28·01	18·49	74·51	11·18	45·04
6	90·32	109·83	20·24	39·75	−19·51	59·99	−21·60	66·42
7	224·74	211·90	59·25	46 41	12·84	105·66	5·71	47·01
8	116·56	128·11	26·89	38·44	−11·55	65·33	−9·91	56·05
9	152·21	132·47	42·31	22·57	19·74	64·88	12·97	42·62
10	141·44	120·43	50·11	29·10	21·01	79·21	14·85	56·00
12	160·58	143·17	54·33	36·92	17·41	91·25	10·84	56·82
15	110·91	123·25	17·51	29·85	−12·34	47·36	−11·13	42·70
16	116·38	122·38	22·31	28·31	−6·00	50·62	−5·16	43·50
17	150·89	150·66	38·49	38·26	0·23	76·75	0·15	50·86
18	111·90	106·66	30·25	25·01	5·24	55·26	4·68	49·38
19	95·37	97·59	26·45	28·67	−2·22	55·12	−2·33	57·80
20	103·36	113·33	22·86	32·83	−9·97	55·69	−9·64	53·88
Total	1740·08	1706·71	457·50	424·13	33·37	881·63	1·92	50·67

TABLE 2(M/5).

Discrepancies between Random Plot and Complete Enumeration, 1938.

District—Mymensingh. Thana—Iswarganj.

JUTE.

Serial No. of Unions.	Total Plots.		Actual Discrepancies.		Sum of Discrepancies.		Discrepancies as percentages of Complete Enumeration.	
	Complete Enumeration.	Random Plot.	Positive.	Negative.	Algebraic.	Absolute.	Algebraic.	Absolute.
(1)	(2·1)	(2·2)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)
7	32·16	36·26	12·33	16·43	−4·10	28·76	−12·75	89·43
9	20·00	22·00	6·66	8·66	−2·00	15·32	−10·00	76·60
17	35·25	28·84	12·83	6·42	6·41	19·25	18·18	54·61
18	23·63	22·83	9·05	8·25	0·80	17·30	3·38	73·21
19	25·02	24·23	9·44	8·65	0·79	18·09	3·16	72·30
TOTAL ...	136·06	134·16	50·31	48·41	1·90	98·72	1·40	72·56

Aus.

7	16·19	2·22	15·36	1·39	13·97	16·75	86·29	103·46
9	5·33	5·66	4·33	4·66	−0·33	8·99	− 6·19	168·67
17	5·76	6·82	4·34	5·40	−1·06	9·74	−18·40	169·10
18	5·00	8·92	3·25	7·17	−3·92	10·42	−78·40	208·40
19	15·01	11·42	8·51	4·92	3·59	13·43	23·92	89·47
Total ...	47·29	35·04	.35·79	23·54	12·25	59·33	25·90	125·46

Aman.

7	35·15	45·77	9·23	19·85	−10·62	29·08	−30·21	82·73
9	55·16	54·00	9·83	8·67	1·16	18·50	2·10	33·54
17	42·23	47·67	10·40	15·84	−5·44	26·24	−12·88	62·14
18	31·66	31·00	10·58	9·92	0·66	20·50	2·08	64·75
19	34·96	40·11	7·04	12·19	−5·15	19·23	−14·73	55·58
Total ...	199·16	218·55	47·08	66·47	−19·39	113·55	− 9·74	57·01

TABLE 2(M/5)—*contd.*

Discrepancies between Random Plot and Complete Enumeration, 1938.

District—Mymensingh. Thana—Iswarganj.

OTHER CROPS.

Serial No. of Unions.	Total Plots		Actual Discrepancies.		Sum of Discrepancies.		Discrepancies as percentage of complete Enumeration.	
	Complete Enumeration.	Random Plot.	Positive.	Negative.	Algebraic.	Absolute.	Algebraic.	Absolute.
(1)	(2·1)	(2·2)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)
7	23·50	22·75	6·00	5·25	0·75	11·25	3·19	47·87
9	20·51	19·34	5·84	4·67	1·17	10·51	5·70	51·24
17	14·76	14·67	4·84	4·75	0·09	9·59	0·61	64·30
18	17·71	15·25	6·29	3·83	2·46	10·12	13·89	57·14
19	12·01	11·24	5·34	4·57	0·77	9·91	6·41	82·52
TOTAL ...	88·49	83·25	28·31	23·07	5·24	51·38	5·92	58·06

TABLE 2(M/6).

Discrepancies between 16-acre and 4-acre Grid Enumeration, 1938.

District—Mymensingh. Thana—Iswarganj.

JUTE.

Serial No. of Unions.	Total plots.		Actual Discrepancies.		Sum of Discrepancies.		Discrepancies as percentages of 16-acre grid Enumeration.	
	16-acre Grid.	4-acre Grid.	Positive.	Negative.	Algebraic.	Absolute.	Algebraic.	Absolute.
(1)	(2·1)	(2·2)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)
2	10·84	6·40	8·51	4·07	4·44	12·58	40·96	116·05
8	31·82	26·01	16·49	10·68	5·81	27·17	18·26	85·39
9	51·19	57·83	10·35	16·99	−6·64	27·34	−12·97	53·41
10	41·07	35·59	17·91	12·43	5·48	30·34	13·34	73·87
18	6·17	8·50	2·17	4·50	−2·33	6·67	−37·76	108·10
20	10·34	10·01	2·59	2·26	0·33	4·85	3·19	46·91
TOTAL ...	151·43	144·34	58·02	50·93	7·09	108·95	4·68	71·95

TABLE 2(m/6).

Discrepancies between 16-acre and 4-acre Grid Enumeration, 1938.

District—Mymensing. Thana—Iswarganj.

AUS.

Serial No. of Unions.	Total Plots.		Actual Discrepancies.		Sum of Discrepancies.		Discrepancies as percentages of 16-acre Enumeration.	
	16-acre Grid.	4-acre Grid.	Positive.	Negative.	Algebraic.	Absolute.	Algebraic.	Absolute.
(1)	(2·1)	(2·2)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)
2	19·16	16·60	11·57	9·01	2·56	20·58	13·36	107·41
8	15·01	14·83	12·84	12·66	0·18	25·50	1·20	169·89
9	14·16	15·18	8·66	9·68	−1·02	18·34	−7·20	129·52
10	37·09	33·76	10·68	7·35	3·33	18·03	8·98	48·61
18	3·82	4·66	2·00	2·84	−0·84	4·84	−21·99	26·70
20	5·67	5·50	2·34	2·17	0·17	4·51	3·00	79·54
TOTAL ...	94·91	90·53	48·09	43·71	4·30	91·80	4·62	96·72

AMAN.

2	63·17	62·08	13·09	12·00	1·09	25·09	1·73	39·72
8	66·83	65·50	13·83	12·50	1·33	26·33	1·99	39·40
9	134·00	128·33	19·00	13·33	5·67	32·33	4·23	24·13
10	106·25	110·49	8 68	12·92	−4·24	21·60	−3·99	20·33
18	17·01	14·17	3·84	1·00	2·84	4·84	16·70	28·45
20	26·31	25·49	2·25	1·43	0·82	3·68	3·12	13 99
TOTAL ...	413·57	406·06	60·69	53·18	7·51	113·87	1·82	27·53

OTHER CROPS.

2	30·83	38·92	6·08	14·17	−8·09	20·25	−26·24	65 68
8	12·34	19·66	1·34	8·66	−7·32	10·00	−59·32	81·04
9	39·65	37·66	8·99	7·00	1·99	15·99	5·02	40·33
10	41·59	46·16	5·17	9·74	−4·57	14·91	−10·99	35·85
18	2·00	1·67	1·33	1·00	0·33	2·33	16·50	116·50
20	4·68	6·00	0·26	1·58	−1·32	1·84	−28·21	39·32
TOTAL ...	131·09	150·07	23·17	42·15	−18·98	65·32	−14·48	49·83

TABLE 2(M/7).

Discrepancies between 16-acre grid and 1-acre Grid Enumeration, 1938.

District—Mymensingh. Thana—Iswarganj.

JUTE.

Serial No. of Unions.	Total Plots.		Actual Discrepancies.		Sum of Discrepancies.		Discrepancies as percentages of 16-acre Grid Enumeration.	
	16-acre Grid.	1-acre Grid.	Positive.	Negative.	Algebraic.	Absolute.	Algebraic.	Absolute.
(1)	(2·1)	(2·2)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)
2	3·50	3·17	3·17	2·84	0·33	6·01	9·43	171·71
8	12·33	14·91	3·00	5·58	−2·58	8·58	−20·92	69·59
9	16·00	24·16	0·51	8·67	−8·16	9·18	−51·00	57·38
10	23·84	18·00	12·01	6·17	5·84	18·18	24·50	76·26
18	10·25	9·17	4·33	3·25	1·08	7·58	10·54	73·95
20	5·00	5·50	2·00	2·50	−0·50	4·50	−10·00	90·00
Total	70·92	74·91	25·02	29·01	−3·99	54·03	−5·63	76·18

Aus.

2	7·16	7·51	4·33	4·68	−0·35	9·01	−4·89	125·84
8	8·98	4·74	8·48	4·24	4·24	12·72	47·22	141·65
9	9·49	3·84	7·50	1·85	5·65	9·35	59·54	98·52
10	13·66	18·58	6·00	10·92	−4·92	16·92	−36·02	123·87
18	2·92	7·33	2·09	6·50	−4·41	8·59	−162·13	315·81
20	5·33	3·83	3·50	2·00	1·50	5·50	28·14	103·19
Total	47·54	45·83	31·90	30·19	1·71	62·09	3·60	130·61

Aman.

2	19·18	21·66	3·35	5·83	−2·48	9·18	−12·93	47·86
8	38·68	36·43	7·58	5·33	2·25	12·91	5·82	33·38
9	48·67	48·33	5·68	5·34	0·34	11·02	0·70	22·64
10	50·84	56·17	5·34	10·67	−5·33	16·01	−10·48	31·49
18	22·91	20·01	4·50	1·60	2·90	6·10	12·66	26·63
20	14·67	15·00	0·00	0·33	−0·33	0·33	− 2·25	2·25
Total	194·95	197·60	26·45	29·10	−2·65	55·55	−1·36	28·49

TABLE 2(M/7).—*contd.*

OTHER CROPS.

Serial No. of Unions.	Total Plots.		Actual Discrepancies.		Sum of Discrepancies.		Discrepancies as percentages of 16-acre Grid Enumeration.	
	16-acre Grid.	1-acre Grid.	Positive.	Negative.	Algebraic.	Absolute.	Abgebraic.	Absolute.
(1)	(2·1)	(2·22)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)
2	23·16	20·66	4·50	2·00	2·50	6·50	10·79	28·07
8	3·01	6·92	0·84	4·75	−3·91	5·59	−129·90	185·71
9	22·84	20·67	3·51	1·34	2·17	4·85	9·50	21·23
10	15·66	11·25	6·33	1·92	4·41	8·25	28·16	52·68
18	3·92	3·49	1·26	0·83	0·43	2·09	10·97	53·32
20	10·00	10·67	0·00	0·67	−0·67	0·67	−6·70	6·70
Total	78·59	73·66	16·44	11·51	4·93	27·95	6·27	35·56

TABLE 2(M/8).

Discrepancies between 4-acre grid and 1-acre Grid Enumeration, 1938.

District—Mymensingh. Thana—Iswarganj.

JUTE.

Serial No. of Unions.	Total Plots.		Actual Discrepancies.		Sum of Discrepancies.		Discrepancies as percentages of 4-acre Grid Enumeration.	
	4-acre Grid.	1-acre Grid.	Positive.	Negative.	Algebraic.	Absolute.	Algebraic	Absolute.
(1)	(2·1)	(2·2)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)
2	30·92	28·34	14·66	12·08	2·58	26·74	8·34	86·48
6	26·93	31·00	5·76	9·83	−4·07	15·59	−15·11	57·89
7	51·66	54·17	13·07	15·58	−2·51	28·65	−4·86	55·46
8	68·58	81·81	21·93	35·16	−13·23	57·09	−19·29	83·25
9	48·01	69·84	11·51	33·34	−21·83	44·85	−45·47	93·42
10	50·75	45·16	17·59	12·00	5·59	29·59	11·01	58·31
15	34·67	29·16	12·60	7·09	5·51	19·69	15·89	56·79
16	31·51	38·17	6·17	12·83	−6·66	19·00	−21·14	60·30
17	90·00	105·23	28·25	43·48	−15·23	71·73	−16·92	79·70
18	33·35	38·67	8·85	14·17	−5·32	23·02	−15·95	69·03
20	34·51	30·41	10·93	6·83	4·10	17·76	11·88	51·46
TOTAL ...	500·89	551·91	151·32	202·39	−51·07	353·71	−10·20	70·62

TABLE 2(M/8)—*contd.*

AUS.

Serial No. of Unions.	Total Plots.		Actual Discrepancies.		Sum of Discrepancies.		Discrepancies as percentages of 4-acre Grid Enumeration.	
	4-acre Grid.	1-acre Grid.	Positive.	Negative.	Algebraic.	Absolute.	Algebraic.	Absolute.
(1)	(2·1)	(2·2)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)
2	35·41	36·16	17·83	18·58	−0·75	36·41	−2·12	102·82
6	18·40	10·99	10·15	2·74	7·41	12·89	40·27	70·05
7	17·15	18·81	8·57	10·23	−1·66	18·80	−9·68	109·62
8	49·91	41·00	24·49	15·58	8·91	40·07	17·85	80·28
9	18·17	10·98	14·84	7·65	7·19	22·49	39·57	123·78
10	27·08	34·66	10·92	18·50	−7·58	29·42	−27·99	108·64
15	13·34	14·18	6·34	7·18	−0·84	13·52	−6·30	101·35
16	10·64	7·24	6·32	2·92	3·40	9·24	31·95	86·84
17	18·49	36 26	4·24	22·01	−17·77	26·25	−92·86	141·97
18	13·49	12·34	5 99	4·84	1·15	10·83	8·53	80·28
20	16·15	16·42	4·23	4·50	−0·27	8·73	−1·67	54·06
TOTAL ...	238·23	239·04	113·92	114·73	−0·81	228·65	−0·34	95·98

TABLE 2(M/8).

Discrepancies between 4-acre Grid and 1-acre Grid Enumeration, 1938.

District—Mymensingh. Thana—Iswarganj.

AMAN.

Serial No. of Unions.	Total Plots.		Actual Discrepancies.		Sum of Discrepancies.		Discrepancies as percentages of 4-acre Grid Enumeration.	
	4-acre Grid.	1-acre Grid.	Positive.	Negative.	Algebraic.	Absolute.	Algebraic.	Absolute.
(1)	(2·1)	(2·2)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)
2	91·20	107·68	13·20	29·68	−16·48	42·88	−18·07	47·02
6	69·09	74·49	5·51	10·91	−5·40	16·42	−7·82	23·77
7	82·85	84·34	11·10	12·59	−1·49	23·69	−1·80	28·59
8	183·10	181·86	27·17	25·95	1·24	53·10	0·68	29·00
9	127·00	115·50	30·67	19·17	11·50	49·84	9·06	39·24
10	92·25	102·17	13·08	23·00	−9·92	36·08	−10·75	39·11
15	49·66	48·67	11·83	10·84	0·99	22·67	1·99	45·65
16	47·49	42·58	10·58	5·67	4·91	16·25	10·34	34·22
17	193·18	154·59	55·75	17·16	38·59	72·91	19·98	37·74
18	69·84	68·17	10·67	9·00	1·67	19·67	2·39	28·16
20	64·67	68·58	6·26	10·17	−3·91	16·43	−6·05	25·41
TOTAL ...	1070·33	1048·63	195·82	174·12	21·70	369·94	2·03	34·56

TABLE 2(M/8)—*contd.*

OTHER CROPS.

Serial No. of Unions.	Total Plots.		Actual Discrepancies.		Sum of Discrepancies.		Discrepancies as percentage of 4-acre Grid Enumeration.	
	4-acre Grid.	1-acre Grid.	Positive.	Negative.	Algebraic.	Absolute.	Algebraic.	Absolute.
(1)	(2·1)	(2·2)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)
2	54·48	39·83	18·81	4·16	14·65	22·97	26·90	42·17
6	22·58	20·52	6·25	4·19	2·06	10·44	9·12	46·24
7	33·34	27·68	11·67	6·01	5·66	17·68	16·98	53·03
8	59·41	56·33	12·00	8·92	3·08	20·92	5·18	35·21
9	46·82	43·68	11·00	7·86	3·14	18·86	6·71	40·28
10	38·91	27·00	17·41	5·50	11·91	22·91	30·61	58·88
15	23·33	28·99	4·17	9·83	−5·66	14·00	−24·26	60·01
16	13·36	15·01	2·26	3·91	−1·65	6·17	−12·35	46·18
17	51·33	56·92	10·57	16·16	−5·59	26·73	−10·89	52·07
18	23·32	20·82	6·66	4·16	2·50	10·82	10·72	46·40
20	22·67	22·59	5·09	5·01	0·08	10·10	0·35	44·55
TOTAL ...	389·55	359·37	105·89	75·71	30·18	181·60	7·75	46·62

TABLE 2(T/1).

District—Tippera. Thana—Laksam.

JUTE.

Method of Enumeration compared.		Total Plots.		Actual Discrepancies.		Sum of Discrepancies.		Discrepancies as percentages of standard A.	
A.	B.	A.	B.	Positive.	Negative.	Algebraic.	Absolute.	Algebraic.	Absolute.
C. E.	16-acre ...	32·66	35·91	16·82	20·07	−3·25	36·89	−9·95	112·95
C. E.	4-acre ...	35·91	41·57	20·17	25·83	−5·66	46·00	−15·76	128·10
C. E.	1-acre ...	84·69	105·71	41·43	62·45	−21·02	103·88	−24·82	122·66
C. E.	R. P. ...	6·00	3·68	2·99	0·67	2·32	3·66	38·67	61·00
16-acre	4-acre ...	18·82	21·92	5·90	9·00	−3·10	14·90	−16·47	79·17
16-acre	1-acre ...	7·50	9·51	2·67	4·68	−2·01	7·35	−26·80	98·00
4-acre	1-acre ...	35·35	59·17	13·96	37·78	−23·82	51·74	−67·38	146·37

TABLE 2(T/1)—*contd.*

District—Tippera. Thana—Laksam.

AUS.

Method of Enumeration compared.		Total Plots.		Actual Discrepancies.		Sum of Discrepancies.		Discrepancies as percentages of standard A.	
A.	B.	A.	B.	Positive.	Negative.	Algebraic.	Absolute.	Algebraic.	Absolute.
C E.	16-acre ...	251·68	293·90	47·17	89·39	−42·22	136·56	−16·78	54·26
C. E.	4-acre ...	357·43	414·25	44·43	101·25	−56·82	145·68	−15·90	40·76
C. E.	1-acre ...	608·34	782·53	68·74	242·93	−174·19	311·67	−28·63	51·23
C. E.	R. P. ...	47·17	55·33	4·75	12·91	−8·16	17·66	−17·30	37·44
16-acre	4-acre ...	141·16	159·25	13·33	31·42	−18·09	44·75	−12·82	31·70
16-acre	1-acre ...	87·85	103·33	14·52	30·00	−15·48	44·52	−17·62	50·68
4-acre	1-acre ...	334·50	389·14	46·43	101·07	−54·64	147·50	−16·33	44·10

Aman.

C. E.	16-acre ...	234·49	182·42	102·64	50·57	52·07	153·21	22·21	65·34
C. E.	4-acre ...	307·41	215·77	137·41	45·77	91·64	183·18	29·81	59·59
C. E.	1-acre ...	748·02	501·62	322·54	76·14	246·40	398·68	32·94	53·30
C. E.	R. P. ...	36·17	26·84	14·66	5·33	9·33	19·99	25·80	55·27
16-acre	4-acre ...	187·51	181·08	29·92	23·49	6·43	53·41	3·43	28·48
16-acre	1-acre ...	118·66	100·99	34·51	16·84	17·67	51·35	14·89	43·27
4-acre	1-acre ...	424·66	356·53	129·18	61·05	68·13	190·23	16·04	44·80

Other Crops.

C. E.	16-acre ...	221·17	227·77	74·65	81·25	−6·60	155·90	−2·98	70·49
C. E.	4-acre ...	213·25	242·41	53·43	82·59	−29·16	136·02	−13·67	63·78
C. E.	1-acre ...	446·95	498·14	87·14	138·33	−51·19	225·47	−11·45	50·45
C. E.	R. P. ...	19·66	23·15	3·58	7·07	−3·49	10·65	−17·75	54·17
16-acre	4-acre ...	128·51	113·75	31·84	17·08	14·76	48·92	11·48	38·07
16-acre	1-acre ...	60·99	61·17	14·66	14·84	−0·18	29·50	−0·30	48·37
4-acre	1-acre ...	267·49	257·16	61·89	51·56	10·33	113·45	3·86	42·41

TABLE 2(T/2)

Discrepancies between 16-acre Grid and Complete Enumeration, 1938.

District—Tippera. Thana—Laksam.

JUTE.

Serial No. of Unions.	Total Plots.		Actual Discrepancies.		Sum of Discrepancies.		Discrepancies as percentages of Complete Enumeration.	
	Complete Enumeration.	16-acre Grid.	Positive.	Negative.	Algebraic.	Absolute.	Algebraic.	Absolute.
(1)	(2·1)	(2·2)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)
1	2·34	11·49	2·34	11·49	−9·15	13·83	−391·03	591·03
7	30·32	24·42	14·48	8·58	5·90	23·06	19·46	76·06
TOTAL ...	32·66	35·91	16·82	20·07	−3·25	36·89	−9·95	112·95
AUS.								
1	191·83	170·17	43·33	21·67	21·66	65·00	11·29	33·88
7	59·85	123·73	3·84	67·72	−63·88	71·56	−106·73	119·56
TOTAL ...	251·68	293·90	47·17	89·39	−42·22	136·56	− 16·78	54·26

Aman.

1	79·33	42·50	51·49	14·66	36·83	66·15	46·43	83·39
7	155·16	139·92	51·15	35·91	15·24	87·06	9·82	56·11
Total ...	234·49	182·42	102·64	50·57	52·07	153·21	22·21	65·34

Other Crops.

1	62·50	111·84	10·66	60·00	−49·34	70·66	−78·49	113·06
7	158·67	115·93	63·99	21·25	42·74	85·24	26·94	53·72
Total ...	221·17	227·77	74·65	81·25	−6·60	155·90	−2·98	70·49

TABLE 2 (T/3).

Discrepancies between 4-acre Grid and Complete Enumeration, 1938.

District—Tippera. Thana—Laksam

JUTE.

Serial No. of Unions.	Total Plots.		Actual Discrepancies.		Sum of Discrepancies.		Discrepancies as percentages of Complete Enumeration.	
	Complete Enumeration.	4-acre grid.	Positive.	Negative.	Algebraic.	Absolute.	Algebraic.	Absolute.
(1)	(2·1)	(2·2)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)
1	15·58	11·07	4·75	10·24	−5·49	14·99	98·39	268·64
3	1·00	5·50	0·67	5·17	−4·50	5·84	450·00	584·00
7	9·17	13·42	2·59	6·84	−4·25	9·43	46·35	102·84
8	4·33	2·08	2·83	0·58	2·25	3·41	51·96	78·75
9	15·83	9·50	9·33	3·00	6·33	12·33	39·99	77·89
TOTAL ...	35·91	41·57	20·17	25·83	−5·66	46·00	15·76	128·10

Aus.

1	137·10	156·09	15·34	34·33	−18·99	49·67	−13·85	36·23
3	81·50	81·67	14·66	14·83	−0·17	29·49	−0·21	36·18
7	49·16	70·09	5·17	26·10	−20·93	31·27	−42·58	63·61
8	46·00	66·24	2·42	22·66	−20·24	25·08	−44·00	54·52
9	43·67	40·16	6·84	3·33	3·51	10·17	8·04	23·29
Total ...	357·43	414·25	44·43	101·25	−56·82	145·68	−15·90	40·76

Aman.

1	107·57	52·41	63·58	8·42	55·16	72·00	51·28	66·93
3	44·50	29·83	21·67	7·00	14·67	28·67	32·97	64·43
7	74·00	59·42	28·67	14·09	14·58	42·76	19·70	57·78
8	52·00	40·76	15·66	4·42	11·24	20·08	21·62	38·62
9	29·34	33·35	7·83	11·84	−4·01	19·67	−13·67	67·04
Total ...	307·41	215·77	137·41	45·77	91·64	183·18	29·81	59·59

TABLE 2(T/3)—*contd.*

OTHER CROPS.

Serial No. of Unions.	Total Plots.		Actual Discrepancies.		Sum of Discrepancies.		Discrepancies as percentages of Complete Enumeration.	
	Complete Enumeration.	4-acre grid.	Positive.	Negative.	Algebraic.	Absolute.	Algebraic.	Absolute.
(1)	(2·1)	(2·2)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)
1	46·75	77·43	9·33	40·01	−30·68	49·34	−65·63	105·54
3	38·00	48·00	6·17	16·17	−10·00	22·34	−26·32	58·79
7	59·67	49·07	21·60	11·00	10·60	32·60	17·76	54·63
8	30·67	23·92	9·00	2·25	6·75	11·25	22·01	36·68
9	38·16	43·99	7·33	13·16	−5·83	20·49	−15·28	53·69
TOTAL ...	213·25	242·41	53·43	82·59	−29·16	136·02	−13·67	63·78

TABLE 2(T/4).

District—Tippera. Thana—Laksham.

JUTE.

Serial No. of Unions.	Total Plots.		Actual Discrepancies.		Sum of Discrepancies.		Discrepancies as percentages of Complete Enumeration.	
	Complete Enumeration.	1-acre grid.	Positive.	Negative.	Algebraic.	Absolute.	Algebraic.	Absolute.
(1)	(2·1)	(2·2)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)
1	12·17	18·75	9·50	16·08	−6·58	25·58	−54·07	210·19
3	13·09	14·86	9·25	11·02	−1·77	20·27	−13·52	154·85
6	17·90	30·74	10·49	23·33	−12·84	33·82	−71·33	188·94
7	4·08	7·17	1·75	4·84	−3·09	6·59	−75·74	161·52
8	5·84	6·59	1·67	2·42	−0·75	4·09	−12·84	70·03
9	31·61	27·60	8·77	4·76	4·01	13·53	12·69	42·80
TOTAL ...	84·69	105·71	41·43	62·45	−21·02	103·88	−24·82	122·66

TABLE 2(T/4)—*contd.*

AUS.

Serial No. of Unions.	Total Plots.		Actual Discrepancies.		Sum of Discrepancies.		Discrepancies as percentages of Complete Enumeration.	
	Complete Enumeration.	1-acre grid.	Positive.	Negative.	Algebraic.	Absolute.	Algebraic.	Absolute.
(1)	(2·1)	(2·2)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)
1	200·16	270·93	21·98	92·75	−70·77	114·73	−35·36	57·32
3	156·27	164·50	22·85	31·08	−8·23	53·93	5·27	34·51
6	21·92	76·91	3·67	58·66	−54·99	62·33	−250·87	284·35
7	37·76	45·34	6·01	13·59	−7·58	19·60	−20·07	51·91
8	76·66	86·59	4·66	14·59	−9·93	19·25	−12·95	25·11
9	115·57	138·26	9·57	32·26	−22·69	41·83	−19·63	36·19
TOTAL ...	608·34	782·53	68·74	242·93	−174·19	311·67	−28·63	51·23

TABLE 2(T/4).

Discrepancies between 1-acre grid and complete Enumeration, 1938.

District—Tippera. Thana—Laksam.

AMAN.

Serial No. of Unions.	Total Plots.		Actual Discrepancies.		Sum of Discrepancies.		Discrepancies as percentages of Complete Enumeration.	
	Complete Enumeration.	1-acre Grid.	Positive.	Negative.	Algebraic.	Absolute.	Algebraic.	Absolute.
(1)	(2·1)	(2·2)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)
1	198·84	83·74	129·09	13·99	115·10	143·08	57·89	71·96
3	95·08	78·00	39·42	22·34	17·08	61·76	17·96	64·96
6	190·24	117·26	83·49	10·51	72·98	94·00	38·36	49·41
7	88·09	73·66	19·76	5·33	14·43	25·09	16·38	28·48
8	54·18	46·73	14·51	7·06	7·45	21·57	13·75	39·81
9	121·59	102·23	36·27	16·91	19·36	53·18	15·92	43·74
TOTAL ...	748·02	501·62	322·54	76·14	246·40	398·68	32·94	53·30

TABLE 2(T/4)—*contd.*

OTHER CROPS.

Serial No. of Union.	Total Plots.		Actual Discrepancies.		Sum of Discrepancies.		Discrepancies as percentages of Complete Enumeration.	
	Complete Enumeration.	1-acre grid.	Positive.	Negative.	Algebraic.	Absolute.	Algebraic.	Absolute.
(1)	(2·1)	(2 2)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)
1	75·83	113·58	16·83	54·58	−37·75	71·41	49·78	94·17
3	103·56	110·64	20·74	27·82	−7·08	48·56	6·84	46·89
6	84·94	90·09	19·19	24·34	−5·15	43·53	6·06	51·25
7	48·07	51·83	4·24	8·00	−3·76	12·24	7·82	25·46
8	61·32	58·09	8·07	4·84	3·23	12·91	5·27	21·05
9	73·23	73·91	18·07	18·75	−0·68	36·82	0·93	50·28
TOTAL ...	446·95	498·14	87·14	138·33	−51·19	225·47	11·45	50·45

TABLE 2(T/5).

Discrepancies between Random Plot and Complete Enumeration, 1938.

District—Tippera. Thana—Laksam.

JUTE.

Serial No. of Unions.	Total Plots.		Actual Discrepancies.		Sum of Discrepancies.		Discrepancies as percentages of Complete Enumeration.	
	Complete Enumeration.	Random Plots.	Positive.	Negative.	Algebraic.	Absolute.	Algebraic.	Absolute.
(1)	(2·1)	(2·2)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)
3	2·50	0·50	2·00	0·00	2·00	2·00	80·00	80·00
9	3·50	3·18	0·99	0·67	0·32	1·66	9·14	47·43
Total	6·00	3·68	2·99	0·67	2·32	3·66	38·67	61·00

AUS.

3	18·50	21·00	3·50	6·00	−2·50	9·50	−13·51	−51·35
9	28·67	34·33	1·25	6·91	−5·66	8·16	−19·74	−28·46
TOTAL ...	47·17	55·33	4·75	12·91	−8·16	17·66	−13·30	−37·44

TABLE 2(T/5).—*contd.*

AMAN.

Serial No. of Unions.	Total Plots.		Actual Discrepancies.		Sum of Discrepancies.		Discrepancies as percentage of Complete Enumeration.	
	Complete Enumeration.	Random Plots.	Positive.	Negative.	Algebraic.	Absolute.	Algebraic.	Absolute.
(1)	(2·1)	(2·2)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)
3	18·00	13·50	8·50	4·00	4·50	12·50	25·00	69·44
9	18·17	13·34	6·16	1·33	4·83	7·49	26·58	41·22
TOTAL ...	36·17	26·84	14·66	5·33	9·33	19·99	25·80	55·27
OTHER CROPS.								
3	9·00	13·00	1·00	5·00	−4·00	6·00	−44·44	66·67
9	10·66	10·15	2·58	2·07	0·51	4·65	−4·78	43·62
TOTAL ...	19·66	23·15	3·58	7·07	−3·49	10·65	−17·75	54·17

TABLE 2(T/6).

Discrepancies between 16-acre grid and 4-acre Grid Enumeration, 1938.

District—Tippera. Thana—Laksam.

JUTE.

Serial No. of Unions.	Total Plots.		Actual Discrepancies.		Sum of Discrepancies.		Discrepancies as percentages of 16-acre Grid Enumeration.	
	16-acre Grid.	4-acre Grid.	Positive.	Negative.	Algebraic.	Absolute.	Algebraic.	Absolute.
(1)	(2·1)	(2·2)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)
1	8·00	9·00	1·00	2·00	−1·00	3·00	−12·50	37·50
2	2·33	2·33	1·00	1·00	0·00	2·00	0·00	85·84
7	4·99	8·09	1·90	5·00	−3·10	6·90	−62·12	138·28
10	3·50	2·50	2·00	1·00	1·00	3·00	28·57	85·71
TOTAL ...	18·82	21·92	5·90	9·00	−3·10	14·90	−16·47	79·17

TABLE 2(T/6)—*contd.*

AUS.

Serial No. of Unions.	Total Plots.		Actual Discrepancies.		Sum of Discrepancies.		Discrepancies as percentages of 16-acre Grid Enumeration.	
	16-acre Grid	4-acre Grid.	Positive.	Negative.	Algebraic.	Absolute.	Algebraic.	Absolute.
(1)	(2·1)	(2·2)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)
1	32·33	32·16	4·33	4·16	0·17	8·49	0·53	26·26
2	27·17	32·17	3·67	8·67	−5·00	12·34	−18·40	45·42
7	24·50	26·59	4·33	6·42	−2·09	10·75	−8·53	43·88
10	57·16	68·33	1·00	12·17	−11·17	13·17	−19·51	23·04
TOTAL ...	141·16	159·25	13·33	31·42	−18·09	44·75	−12·88	31·70
			AMAN.					
1	32·34	32·67	3·17	3·50	−0·33	6·67	−1·02	20·62
2	26·33	35·00	3·00	11·67	−8·67	14·67	−32·93	55·72

7	39·17	35·07	10·25	6·15	4·10	16·40	10·47	41·87
10	89·67	78·34	13·50	2·17	11·33	15·67	12·64	17·48
TOTAL ...	187·51	181·08	29·92	23·49	6·43	53·41	3·43	28·48

OTHER CROPS.

1	35·33	34·17	5·33	4·17	1·16	9·50	3·28	26·89
2	35·17	21·50	16·17	2·50	13·67	18·67	38·87	53·09
7	15·34	14·25	7·00	5·91	1·09	12·91	7·10	84·16
10	42·67	43·83	3·34	4·50	−1·16	7·84	2·72	18·37
TOTAL ...	128·51	113·75	31·84	17·08	14·76	48·92	11·48	38·07

TABLE 2 (T/7).

Discrepancies between 16-acre Grid and 1-acre Grid Enumeration, 1938.

District—Tippera. Thana—Laksam.

JUTE.

Serial No. of Unions.	Total Plots.		Actual Discrepanies.		Sum of Discrepancies.		Discrepancies as percentages of 16-acre Grid Enumeration.	
	16-acre Grid.	1-acre Grid.	Positive.	Negative.	Algebraic.	Absolute.	Algebraic.	Absolute.
(1)	(2·1)	(2·2)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)
1	1·17	0·50	1·17	0·50	0·67	1·67	57·27	142·74
2	2·33	3·17	0·66	1·50	−0·84	2·16	−36·05	92·70
7	2·50	2·67	0·17	0·34	−0·17	0·51	−6·80	20·40
10	1·50	3·17	0·67	2·34	−1·67	3·01	−111·33	200·67
TOTAL ...	7·50	9·51	2·67	4·68	−2·01	7·35	−26·80	98·00
				AUS.				
1	15·83	19·00	1·83	5·00	−3·17	6·83	−20·03	43·15
2	21·34	17·33	9·17	5·16	4·01	14·33	18·79	67·15

7	11·50	12·33	0·17	1·00	−0·83	1·17	−7·22	9·49
10	39·18	54·67	3·35	18·84	−15·49	22·19	−39·54	56·64
TOTAL ...	87·85	103·33	14·52	30·00	−15·48	44·52	−17·62	50·68

AMAN.

1	19·16	19·50	3·83	4·17	−0·34	8·00	1·77	41·75
2	27·83	29·66	7·17	9·00	−1·83	16·17	6·58	58·10
7	12·01	11·67	1·67	1·33	0·34	3·00	2·83	25·71
10	59·66	40·16	21·84	2·34	19·50	24·18	32·68	40·53
TOTAL ...	118·66	100·99	34·51	16·84	17·67	51·35	14·89	43·27

OTHER CROPS.

1	14·84	12·00	6·00	3·16	2·84	9·16	19·14	61·73
2	21·50	22·84	5·50	6·84	−1·34	12·34	6·23	57·40
7	7·99	7·33	1·16	0·50	0·66	1·66	8·26	20·78
10	16·66	19·00	2·00	4·34	−2·34	6·34	14·04	38·04
TOTAL ...	60·99	61·17	14·66	14·84	−0·18	29·50	0·30	48·37

TABLE 2(T/8).

Discrepancies between 4-acre Grid and 1-acre Grid Enumeration, 1938.

District—Tippera. Thana—Laksam.

JUTE.

Serial No. of Unions.	Total plots.		Actual Discrepancies		Sum of Discrepancies.		Discrepancies as percentages of 4-acre Grid Enumeration.	
	4-acre grid.	1-acre grid.	Positive.	Negative.	Algebraic.	Absolute.	Algebraic.	Absolute.
(1)	(2·1)	(2·2)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)
1	4·07	5·50	2·57	4·00	−1·43	6·57	−35·14	161·43
2	4·02	2·84	2·52	1·34	1·18	3·86	29·35	96·02
3	3·43	11·06	0·55	8·18	−7·63	8·73	−222·45	254·52
4	8·92	11·44	3·08	5·60	−2·52	8·68	−28·25	97·31
7	4·50	6·50	1·67	3·67	−2·00	5·34	−44·44	118·67
8	1·00	3·58	0·00	2·58	−2·58	2·58	−258·00	258·00
9	1·58	9·83	0·24	8·49	−8·25	8·73	−522·15	552·53
10	7·83	8·42	3·33	3·92	−0·59	7·25	−7·54	92·59
TOTAL ...	35·35	59·17	13·96	37·78	−23·82	51·74	−67·38	146·37

1	47·76	64·17	3·84	20·25	−16·41	24·09	−34·36	50·44
2	65·17	68·50	10·83	14·16	−3·33	24·99	−5·11	38·35
3	28·58	34·25	6·83	12·50	−5·67	19·33	−19·84	67·63
4	60·24	67·39	7·51	14·66	−7·15	22·17	−11·87	36·80
7	19·00	20·67	1·17	2·84	−1·67	4·01	−8·79	21·10
8	36·33	39·58	1·58	4·83	−3·25	6·41	−8·94	17·64
9	22·59	24·17	2·33	3·91	−1·58	6·24	−6·99	27·64
10	54·83	70·41	12·34	27·92	−15·58	40·26	−28·42	73·43
TOTAL ...	334·50	389·14	46·43	101·07	−54·64	147·50	−16·33	44·10

TABLE 2(T/8)—(*contd*).

Discrepancies between 4-acre Grid and 1-acre Grid Enumeration, 1938.

District—Tippera. Thana—Laksam.

AMAN.

Serial No. of Unions.	Total Plots.		Actual Discrepancies.		Sum of Discrepancies.		Discrepancies as percentages of 4-acre Grid Enumeration.	
	4-acre Grid.	1-acre Grid.	Positive.	Negative.	Algebraic.	Absolute.	Algebraic.	Absolute.
(1)	(2·1)	(2·2)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)
1	68·59	43·16	31·84	6·41	25·43	38·25	37·08	55·77
2	73·16	74·85	12·66	14·35	−1·69	27·01	−2·31	36·92
3	35·07	22·28	15·08	2·29	12·79	17·37	36·47	49·53
4	59·93	53·76	16·68	10·51	6·17	27·19	10·30	45·37
7	24·51	23·50	3·34	2·33	1·01	5·67	4·12	25·13
8	40·16	36·91	6·58	3·33	3·25	9·91	8·09	24·68

9	34·08	27·83	10·66	4·41	6·25	15·07	18·34	44·22
10	89·16	74·24	32·34	17·42	14·92	49·76	16·73	35·81
TOTAL ...	424·66	356·53	129·18	61·05	68·13	190·23	16·04	44·80

OTHER CROPS.

1	40·58	48·17	7·17	14·76	−7·59	21·93	−18·70	54·04
2	32·65	28·81	14·99	11·15	3·84	26·14	11·76	80·06
3	20·92	20·41	5·00	4·49	0·51	9·49	2·44	45·37
4	73·91	70·41	11·16	7·66	3·50	18·82	4·74	25·46
7	19·99	17·33	4·66	2·00	2·66	6·66	13·31	33·32
8	13·51	10·93	4·16	1·58	2·58	5·74	19·10	42·49
9	25·75	22·17	5·16	1·58	3·58	6·74	13·91	26·18
10	40·18	38·93	9·59	8·34	1·25	17·93	3·11	44·62
TOTAL ...	267·49	257·16	61·89	51·56	10·33	113·45	3·86	42·41

TABLE (3·1). INDEX NUMBER OF OUTPUT, 1938.

Field Investigators: Complete Enumeration.

Serial No.	Gross Index of Output	Adjusted Index corrected for mistakes	Serial No.	Gross Index of Output	Adjusted Index corrected for mistakes
1	123	145	20	102	82
2	106	126	21	68	36
3	151	120	22	96	16
4	121	127	23	77	76
5	128	150	24	108	124
6	38	46	25	89	108
7	91	81	26	104	116
8	66	77	27	132	155
9	121	144	28	57	59
10	108	128	29	28	−15
11	108	116	30	151	178
12	121	105	31	85	9
13	32	20	32	125	148
14	64	76	33	98	116
15	85	99	34	98	−30
16	117	110	35	134	124
17	79	63	36	61	153
18	113	113	37	87	89
19	115	122	38	108	77

TABLE (3·1)—*contd.*

Serial No.	Gross Index of Output	Adjusted Index corrected for mistakes	Serial No.	Gross Index of Output	Adjusted Index corrected for mistakes
39	79	92	57	72	64
40	91	109	58	94	111
41	81	96	59	94	111
42	68	80	60	102	121
43	98	115	61	121	142
44	83	98	62	81	89
45	108	114	63	130	34
46	79	107	64	151	83
47	98	116	65	130	147
48	134	135	66	134	130
49	149	176	67	94	97
50	79	93	68	77	91
51	70	83	69	57	50
52	123	146	70	96	114
53	85	101	71	170	202
54	157	134	62	68	79
55	74	87	73	125	143
56	103	104	74	151	16

TABLE (3·2). INDEX NUMBER OF OUTPUT, 1938.
Statistical Section.

Serial No.	Output Index				
	July	August	September	October	Index No. of mistakes (October)
1	...	64	107	84	89
2	...	...	...	87	...
3	...	...	...	98	111
4	...	...	75	81	155
5	143	...	...	139	...
6	98	80	104	...	...
7	75	...	...	...	...
8	...	...	107	109	...
9	...	...	66	...	...
10	...	...	57	...	...
11	57	...	...	...	...
12	...	...	...	79	66
13	105	...	...	...	...
14	...	...	87	102	133
15	...	113	113	131	199
16	82	91	110	...	...
17	64	78	103	...	...
18	...	...	82	100	509
19	...	...	...	134	44

TABLE (3·2). *Contd.*

Serial No.	Output Index				
	July	August	September	October	Index No. of mistakes (October)
20	79	...	...	...	...
21	...	...	62	...	...
22	116	89	167	93	...
23	133	97	87	92	66
24	...	...	69	...	...
25	99	70	...	...	...
26	...	...	56	84	89
27	59	...	...	...	...
28	...	...	107	100	89
29	...	...	84	84	22
30	...	...	103	...	...
31	...	...	60	80	22
32	139	...	...	...	...
33	...	173	112	100	...
34	92	89	82	...	...
35	25	...	...	...	...
36	131	157	141	...	...
37	86	...	...	...	...
38	114	...	...	...	...
39	...	...	76	...	...

TABLE (3·2).—*Contd.*

Serial No.	Output Index				
	July	August	September	October	Index No. of mistakes (October)
40	129	119	...	65	...
41	...	...	...	111	44
42	...	...	..	120	44
43	...	141	131	163	...
44	...	...	...	131	44
45	123	...	...	...	...
46	...	76	96	...	...
47	92	...	...	...	...
48	145	91	167	...	...
49	...	...	115	79	354
50	...	...	...	107	22
51	...	...	...	92	22
52	...	...	...	83	89
53	...	141	177	...	...
54	132	105	105	116	22
55	...	...	91	...	...
56	81	97	108	...	...
57	103	85	144	72	...
58	119	76	...	97	...
59	...	...	111	114	44

TABLE (3·2).—*Contd.*

Serial No.	Output Index				
	July	August	September	October	Index No. of mistakes (October)
60	...	...	75	124	111
61	...	123	109	...	...
62	72	107	65	...	...
63	...	150	...	96	...
64	...	136	147	...	...
65	79	...	...	...	...
66	...	...	...	78	...
67	...	63	...	...	...
68	...	61	...	...	...
69	...	...	89	89	44
70	...	...	...	100	44
71	140	82	79	100	111
72	...	83	...	...	...
73	87	...	...	86	111
74	...	61	61	...	...

TABLE (5·1).

Estimated Proportion under Jute by different sizes of Grids, 1938.

Sampling Methods.	Dacca.		Murshidabad.		Mymensingh.		Pabna.		Rajshahi.		Rangpur.		Tippera.	
	n	$p \pm$s. e.	n	$p \pm$s. e.	n	$p \pm$s. e.	n	$p \pm$s. e.	n	$p \pm$s. e.	n	$p \pm$s. e.	n	$p \pm$s. e.
(1)	(2·1)	(2·2)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)	(6·1)	(6·2)	(7·1)	(7·2)	(8·1)	(8·2)
1-acre ...	144	0·2602	204	0·1859	1739	0·3892	396	0·0596	278	0·2994	747	0·3176	1005	0·0384
		±0·0243	...	±0·0194	...	±0·0078	...	±0·0065	...	±0·0193	...	±0·0121	...	±0·0028
4-acre ...	...	...	76	0·1835	411	0·3610	176	0·0859	...	...	194	0·3659	191	0·0355
				±0·0297	...	±0·0134	...	±0·0092	...	...	...	±0·0214	...	±0·0061
16-acre ...	...	...	9	0·1786	75	0·3228	9	0·0536	47	0·3449	62	0·3741	44	0·0308
				±0·0872	...	±0·0290	...	±0·0133	...	±0·0354	...	±0·0289	...	±0·0189

TABLE (5·21) Variability for different sizes of Grids, 1938.

Sampling Methods.	n	$p=0·2602$	n	$p=0·1827$	n	$p=0·3267$	n	$p=0·0519$	n	$p=0·2985$	n	$p=0·3234$	n	$p=0·0319$

Standard Deviation with Standard Error.

1-acre ...	144	0·2931	204	0·2777	1739	0·3269	396	0·1301	278	0·3219	747	0·3294	1005	0·0921
		±0·0172	...	±0·0137	...	±0·0055	...	±0·0046	...	±0·0136	...	±0·0086	...	±0·0020
4-acre ...	...	...	76	0·2590	411	0·2714	176	0·1223	...	...	194	0·2976	191	0·0847
				±0·0210	...	±0·0095	...	±0·0065	...	...	...	±0·0151	...	±0·0043
16-acre ...	...	...	9	0·2615	75	0·2516	9	0·0398	47	0·2426	62	0·2279	44	0·0504
				±0·0617	...	±0·0205	...	±0·0094	...	±0·0250	...	±0·0204	...	±0·0134

TABLE (5·22) Percentage Variability.

1-acre ...	144	112·64	204	152·00	1739	100·06	396	250·67	278	107·84	747	101·85	1005	288·71
4-acre ...	...	...	77	141·76	411	83·07	176	235·65	...	...	194	92·02	191	265·52
16-acre ...	...	...	9	143·13	75	77·01	9	76·69	47	81·27	62	70·47	44	158·00

TABLE (5·3)

Comparison of Estimated Area under Jute based on different sizes of Grids, 1938.

Size of Grid.	n= No. of Grids.	$\sqrt{n}$	Standard Deviation.	Standard Error.	Estimated proportion under Jute with Standard Error.	Estimated Area under Jute with Standard Error.	Difference between different Estimates with corresponding Standard Error and t-value within brackets.	
							(1-acre)	(4-acre)
(1)	(2·1)	(2·2)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)
District—Mymensingh. Thana—Iswarganj. (Area 1,29,920 acres).								
1-acre	1739	41·70	0·3269	0·0078	0·3892±0·0078	50565±1013	...	...
4-acre	411	20·27	0·2714	0·0134	0·3610±0·0134	46901±1741	3664±2261 (1·62)	...
16-acre	75	8·66	0·2516	0·0290	0·3228±0·0290	41938±3768	8627±4963 (1·74)	4963±4378 (1·13)
District—Murshidabad. Thana—Beldanga. (Area 91,250 acres).								
1-acre	204	14·28	0·2777	0·0194	0·1859±0·0194	17014±1775	...	...
4-acre	76	8·66	0·2590	0·0297	0·1835±0·0297	16794±2718	220±3359 (0·065)	...
16-acre	9	3·00	0·2615	0·0872	0·1786±0·0872	16345±7981	669±8639 (0·077)	449±8365 (0·054)

District—Pabna. Thana—Sara. (Area 60·800 acres).

1-acre	396	19·90	0·1301	0·0065	0·0596±0·0065	3624±395	...	...
4-acre	176	13·21	0·1223	0·0092	0·0859±0·0092	5223±559	1599±705 (2·27)	...
16-acre	9	3·00	0·0398	0·0133	0·0536±0·0133	3259±809	365±2645 (0·138)	1964±2493 (0·788)

District Rangpur. Thana—Domar. (Area—62,080 acres).

1-acre	747	27·33	0·3294	0·0121	0·3176±0·0121	19717±751	...	...
4-acre	194	13·93	0·2976	0·0214	0·3659±0·0214	22715±1329	2998±1614 (1·86)	...
16-acre	62	7·87	0·2279	0·0289	0·3741±0·0289	23224±1794	3507±2651 (1·32)	509±2553 (0·199)

District Rajshahi. Thana—Badalgachhi. (Area—51,840 acres).

1-acre	278	16·67	0·3219	0·0193	0·2994±0·0193	15521±1001	...	...
4-acre	...	...	...	...	...	...	...	...
16-acre	47	6·86	0·2426	0·0354	0·3449±0·0354	17880±1835	2359±2551 (0·925)	...

District Tipperah. Thana—Laksam. (Area—1,26,080 acres).

1-acre	1005	31·70	0·0921	0·0028	0·0384±0·0028	4841±353	...	...
4-acre	191	13·82	0·0847	0·0061	0·0355±0·0061	4476±769	365±908 (0·403)	...
16-acre	44	6·63	0·0504	0·0189	0·0308±0·0189	3883±2383	958∓1765 (0·543)	593±1677 (0·353

TABLE (5·4).

Estimated Area under Jute by different sizes of Grids, 1938.

——	Dacca.	Murshidabad.	Mymensingh.	Pabna.	Rajshahi.	Rangpur.	Tipperah.
Area (in acres).	68480	91250	129920	60800	51840	62080	126080
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1-acre	17819±1664	17014±1775	50565±1013	3624±395	15521±1001	19717±751	4841±353
4-acre	...	16794±2718	46901±1741	5223±559	...	22715±1329	4476±769
16-acre	...	16345±7981	41938±3768	3259±809	17880±1835	23224±1794	3883±2383

TABLE (5·5.)

Values of "t" for testing the significance of differences between different Estimates of Acreage under Jute, 1938.

Sampling Methods.	Murshidabad.		Mymensingh.		Pabna.		Rajshahi.		Rangpur.		Tipperah.	
	D.F.	t	D.F.	t	D.F.	t	D.F.	t	D.F.	t	D.F.	t
(1)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)	(6·1)	(6·2)	(7·1)	(7·2)	(8·1)	(8·2)
1-acre and 4-acre ...	278	0·065	2148	1·62	570	2·27	...	...	939	1·36	1194	0·403
1-acre and 16-acre ...	211	0·077	1812	1·74	403	0·138	323	0·925	807	1·32	1047	0·543
4-acre and 16-acre ...	83	0·054	484	1·13	183	0·788	...	....	254	0·199	233	0·353

TABLE (5·61).

Area Distribution of Random Plots.

District—Mymensingh. Thana—Iswarganj.

Class Interval (in acres).	Plots with Jute.	Plots without Jute.	Total Plots.	Actual areas under Jute.	Plots with 100% Jute.
0·00—0·25	29	30	59	74	19
0·26—0·50	117	88	205	137	83
0·51—0·75	97	69	166	87	56
0·76—1·00	77	51	128	66	50
1·01—1·25	37	28	65	33	18
1·26—1·50	20	20	40	15	9
1·51—1·75	11	9	20	13	3
1·76—2·00	15	6	21	10	7
2·01—3·00	34	10	44	16	8
3·01—4·00	10	9	19	...	...
4·01—5·00	2	3	5	1	1
5·01—10·00	3	7	10	...	...
10·01—15·00	...	1	1	1	...
15·01—20·00	...	3	3	...	...
20·01—30·00	...	2	2	...	...
30·01—40·00	1	1	2	...	...
40·01—50·00	...	1	1	...	...
TOTAL ...	453	338	791	453	254

D. F. = 10, Chi-square = 22·3669, p = 0·0135

TABLE (5·62).

Distribution of Jute Percentages.

District—Mymensingh.

Thana—Iswarganj.

Class Interval (in Jute percentage).	Frequency.
(No Jute)	338
1—10 per cent,	2
11—20	16
21—30	12
31—40	30
41—50	41
51—60	18
61—70	33
71—80	19
81—90	18
91—99	10
100 (all Jute)	254
TOTAL ...	791

TABLE (5·71)

Area Distribution of Random Plots.

District—Rangpur. Thana—Domar.

Class Interval in acre.	Plots with Jute.	Plots without Jute.	Total Plots.	Actual area under Jute.	Plots with 100% Jute.
0·00—0·25	36	58	94	41	31
0·26—0·50	35	29	64	39	32
0·51—0·75	19	25	44	22	15
0·76—1·00	15	14	29	17	12
1·01—1·25	5	15	20	8	3
1·26—1·50	10	9	19	9	8
1·51—1·75	5	9	14	2	...
1·76—2·00	3	1	4	...	...
2·01—3·00	7	8	15	4	2
3·01—4·00	1	6	7	...	...
4·01—5·00	2	2	4	1	1
5·01—10·00	5	6	11	...	...
10·01—15·00	...	2	2	...	...
40·01—50·00	...	1	1	...	...
TOTAL ...	143	185	328	143	104

D.F. = 10, Chi-square = 13·15, p = 0·2162

TABLE (5·72)

Distribution of Jute Percentages.

Dist.——Rangpur. Thana—Domar.

Class Interval (in Jute percentages).	Frequency.
(No Jute)	185
1—10 per cent.	1
11—20	2
21—30	7
31—40	3
41—50	5
51—60	9
61—70	4
71—80	8
81—90	...
91—99	...
100 (all Jute)	104
TOTAL ...	328

TABLE (5·8)

Standard Deviation and Number of Grids required to attain given Accuracy.

District.	Thana.	Values of Standard Deviation.										Proportionate numbers required to give results of same Accuracy.				
		Random Plots		1-acre		4-acre		16-acre		36-acre		Random Plots.	1-acre	4-acre	16-acre	36-acre
		n		*n*		*n*		*n*		*n*						
(1·1)	(1·2)	(2·1)	(2 2)	(3·1)	(3·2)	(4·1)	(4·2)	(5·1)	(5·2)	(6·1)	(6·2)	(7)	(8)	(9)	(10)	(11)
24-Parganas ...	Deganga (1937)	8554	·1311	559	·0860	316	·0848	215	·0449	213	·0399	100	43*	42*	12*	9
Dacca ...	Kaliganj ...	...	...	144	·2913	...	...	...	...	...	...	...	...	...	...	...
Murshidabad ...	Beldanga ...	...	...	204	·2777	76	·2590	9	·2615	...	...	...	...	...	...	...
Mymensingh ...	Iswarganj ...	791	·4450	1739	·3269	411	2714	75	·2516	...	...	100	54	37	32	...
Nadia ...	Nakasipara ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Pabna ...	Sara ...	326	·1571	396	·1301	176	·1223	9	·0398	...	...	100	68	61	6	...
Rajshahi ...	Badalgachi ...	263	·4361	278	·3219	...	...	47	·2426	...	...	100	54	...	31	...
Rangpur ...	Domar ...	328	·4165	747	·3294	194	·2976	62	·2279	...	...	100	63	51	30	...
Tipperah ...	Laksam ...	591	·1566	1005	·0921	191	·0840	44	·0504	...	...	100	35	29	10	...

*Estimated from model sampling.

TABLE (6·1)

NUMBER OF PLOTS ENUMERATED PER NET WORKING DAY, 1938 SURVEY,

Density per Square mile.	R. P.	1 Acre.	4 Acres.	16 Acres.
1	.....	.....	63·13	144·18
2	.....	29·86	69·44	167·79
3	11·56	.....	81·91	205·28
4	.....	38·10	86·80	.....
5	.....	.....	92·73	.....
6	12·10	56·58	.....	.....
8	.....	65·69	.....	.....
9	17·74	.....	.....	.....
10	.....	67·00	.....	.....
12	19·59	.....	.....	.....
15	22·81	.....	.....	.....

TABLE (6·2)

NUMBER OF SAMPLES ENUMERATED PER NET WORKING DAY, 1938 SURVEY.

1	.....	.....	3·16	2·40
2	.....	4·27	3·47	2·80
3	11·56	.....	4·10	3·42
4	.....	5·44	4·34	.....
5	.....	.....	4·64	.....
6	12·10	8·08	.....	.....
8	.....	9·38	.....	.....
9	17·74	.....	.....	.....
10	.....	11·00	.....	.....
11	19·59	.....	.....	.....
15	22·88	.....	.....	.....

TABLE (6·3)

FIELD INVESTIGATORS: UTILISATION OF NET WORKING DAYS, 1938 SURVEY.

Method of Enumeration.	No. of Samples.	Area in Acres.	Journey percentage.	Miscellaneous percentage.	Field work percentage.	Overhead percentage.	Total net workingdays.
Complete Enumeration.	—	264857	6·60	1·98	21·61	69·81	100·00
Random Plots.	2407	3420	11·15	5·54	14·88	68·43	100·00
1-acre ...	4659	4610	10·72	4·91	13·89	70·48	100·00
4-acre ...	1048	4198	11·22	5·51	11·47	71·80	100·00
16-acre ...	259	3955	9·59	6·06	16·61	67·74	100·00
Weighted Average	.....	.....	8·47	3·41	18·05	70·07	100·00

TABLE (7·1.)

ESTIMATED COST (IN RUPEES) PER SAMPLE AND PER SQUARE MILE.

Sampling size.	Density per sq. mile.	No. of field units.	Per Sample.			Per Square Mile.		
			Laboratory.	Field.	Total.	Laboratory.	Field.	Total.
(1·1)	(1·2)	(1·3)	(2·1)	(2·2)	(2·3)	(3·1)	(3·2)	(3·3)
Random	3	289	0·143	0·324	0·467	0·429	0·972	1·401
Plots.	4	...	0·139	0·320	0·469	0·556	1·280	1·836
	6	242	0·137	0·310	0·447	0·822	1·860	2·682
	9	1242	0·136	0·212	0·348	1·224	1·908	3·132
	12	666	0·135	0 191	0·326	1·620	2·292	3·912
	15	267	0·132	0·164	0·296	1·980	2·460	4·440
1-acre	1	...	0·598	0·996	1·594	0·598	0·996	1·594
	2	183	0·563	0·879	1·442	1·126	1·758	2·884
	3	...	0·545	0·765	1·310	1·635	2·295	3·930

	4	385	0·527	0·689	1·216	2·108	2·756	4·864
	5	...	0·516	0·557	1·073	2·380	2·785	5·365
	6	847	0·502	0·464	0·966	3·012	2·784	5·796
	8	754	0·470	0·400	0·870	3·760	3·200	6·960
4-acre	1	83	0·658	1·188	1·846	0·658	1·188	1·846
	2	228	0·641	1·080	1·721	1·282	2·160	3·442
	3	296	0·612	0·915	1·527	1·836	2·745	4·581
	4	295	0·601	0·851	1·452	2·404	3·404	5·808
	5	39	0·591	0·809	1·400	2·955	4·045	7·000
5-acre 1937	12	890	1·005	0·421	1·386	11·580	5·052	16·632
16-acre	1	47	1·407	1·561	2·968	1·407	1·561	2·968
	2	132	1·351	1·341	2·692	2·702	2·682	5·384
	3	64	1·332	1·096	2·428	3·996	3·288	7·284
36-acre Interpolated.	3	...	2·657	2·250	4·907	7·971	6·750	14·721

TABLE (7·2.)

INTERPOLATED VALUES OF DENSITY *n*.

(Number of Sampling Units per Square Mile.)

Expenditure in Rupees per Square Mile.	Random Plots.	1-Acre.	4-Acre.	16-Acre.	36-Acre.
Re. 1-0-0 ...	2·0	0·6	0·5	0·3	0·21
Rs. 1-8-0 ...	3·2	0·9	0·8	0·5	0·32
„ 2-0-0 ...	4·5	1·3	1·1	0·7	0·43
„ 2-8-0 ...	6·1	1·7	1·4	0·9	0·53
„ 3-0-0 ...	7·9	2·1	1.7	1·0	0·64
„ 3-8-0 ...	10·0	2·6	2·1	1·2	0·76
„ 4-0-0 ...	12·4	3·1	2·4	1·4	0·85
„ 5-0-0 ...	17·6	4·4	3·2	1·8	1·06
„ 6-0-0 ...	...	6·1	4·1	2·3	1·28

TABLE (7·3.)

Values of $1/\sqrt{n}$ per Square Mile.

Re. 1-0-0 ...	0·7071	1·2909	1·4142	1·8257	2·1822
Rs. 1-8-0 ...	0·5590	1·0541	1·1180	1·4142	1·7678
„ 2-0-0 ...	0·4714	0·8771	0·9535	1·1952	1·5250
„ 2-8-0 ...	0·4049	0·7670	0·8452	1·0541	1·3736
„ 3-0-0 ...	0·3558	0·6901	0·7670	1·0000	1·2500
„ 3-8-0 ...	0·3162	0·6202	0·6901	0·9129	1·1471
„ 4-0-0 ...	0·2923	0·5680	0·6454	0·8452	1·0847
„ 5-0-0 ...	0·2384	0·4767	0·5590	0·7454	0·9713
„ 6-0-0 ...	...	0·4049	0·4939	0·6594	0·8839

TABLE (7·4)

Standard Error per Square Mile.

District.	Dacca.					Deganga.					Murshidabad.				Mymensingh.			
Size of Unit.	Random Plot.	1-acre.	4-acre.	16 acre.	36-acre.	Random Plot.	1-acre.	4-acre.	16-acre.	36-acre.	Random Plot.	1-acre.	4-acre.	16-acre.	Random Plot.	1-acre.	4-acre.	16-acre.
Number of Units.	...	144	...	...	...	8554	559	316	215	213	...	204	76	9	791	1739	411	75
Standard Deviation.	...	0·291	...	...	...	0·131	0·086	0·085	0·045	0·040	...	0·278	0·259	0·262	0·445	0·327	0·271	0·252
Rate of Expenditure per Square Mile — Re. 1-0 ...	...	0·376	...	...	...	0·093	0·111	0·120	0·082	0·087	...	0·358	0·366	0·477	0·315	0·422	0·384	0·459
Re. 1-8 ...	...	0·307	...	...	...	0·073	0·091	0·095	0·064	0·070	...	0·293	0·290	0·370	0·249	0·345	0·303	0·356
Rs. 2-0	...	0·256	...	...	...	0·062	0·076	0·081	0·054	0·061	...	0·244	0·247	0·312	0·210	0·287	0·259	0·301
Rs. 2-8 ...	...	0·223	...	...	...	0·053	0·066	0·072	0·047	0·055	...	0·213	0·219	0·276	0·180	0·251	0·229	0·265
Rs. 3-0 ...	...	0·201	...	...	...	0·047	0·059	0·065	0·045	0·050	...	0·192	0·199	0·262	0·158	0·226	0·208	0·252
Rs. 3-8 ...	...	0·181	...	...	...	0·042	0·053	0·058	0·041	0·046	...	0·172	0·179	0·239	0·141	0·203	0·187	0·230
Rs. 4-0 ...	...	0·166	...	...	...	0·038	0·049	0·055	0·038	0·043	...	0·158	0·167	0·221	0·130	0·186	0·175	0·213
Rs. 5-0 ...	...	0 139	...	...	...	0·031	0·041	0·047	0·034	0·039	...	0·132	0·145	0·195	0·106	0·156	0·152	0·188
Rs. 6-0 ...	...	0·118	...	...	...	...	0·035	0·042	0·030	0·035	...	0·112	0·128	0·172	...	0·132	0·134	0·166

TABLE (7·4).

Standard Error per Square Mile—*(Contd).*

District.		Pabna.				Rajshahi.				Rangpur.				Tippera.			
Size of Units.		Random plot.	1-acre.	4-acre.	16-acre.	Random Plot.	1 acre.	4-acre.	16-acre.	Random Plot.	1-acre.	4-acre.	16-acre.	Random Plot.	1-acre.	4-acre.	16-acre.
Number of Units.		326	396	176	9	263	278		47	328	747	194	62	591	1005	191	44
Standard Deviation.		0·157	0·130	0·122	0·040	0·436	0·322		0·243	0·416	0·329	0·298	0·228	0·157	0·092	0·084	0·050
Rate of Expenditure per Square Mile	Re. 1-0 ...	0·111	0·168	0·173	0 073	0·308	0·416		0·443	0·294	0·425	0·421	0·416	0·111	0·119	0·191	0·092
	Re. 1-8 ...	0·088	0·137	0·137	0·056	0·244	0·339		0·343	0·233	0·347	0·333	0·322	0·088	0·097	0·094	0·071
	Rs. 2-0 ...	0·074	0·114	0·117	0·048	0·206	0·282		0·290	0·196	0·289	0·284	0·272	0·074	0·081	0·080	0·060
	Rs. 2-8 ...	0·064	0·100	0·103	0·042	0·177	0·247		0·256	0·169	0·253	0·252	0·240	0·063	0·071	0·071	0·053
	Rs. 3-0 ...	0·056	0·090	0·094	0·040	0·155	0·222		0·243	0·148	0·227	0·228	0·228	0·056	0·064	0·064	0·050
	Rs. 3-8 ...	0·050	0·081	0·084	0·036	0·138	0·200		0·221	0·132	0·204	0·205	0·208	0·050	0·057	0·058	0·046
	Rs. 4-0 ...	0·046	0·074	0·079	0·034	0·128	0·183		0·205	0·122	0·187	0·192	0·193	0·046	0·052	0·054	0·043
	Rs. 5-0 ...	0·037	0·062	0·068	0·030	0·104	0·153		0·181	0·099	0·157	0·166	0·170	0·037	0·044	0·047	0·038
	Rs. 6-0 ...	...	0·053	0·060	0·026	...	0·130		0·160	...	0·133	0·147	0·150	...	0·037	0·042	0·033

TABLE (7·5.)

Percentage Variability per Square Mile.

Expenditure per Square Mile.	Deganga, 1937.					Dacca, 1938.				Murshidabad, 1938.				Mymensingh, 1938.			
	R. P.	1 acre.	4 acre.	16 acre.	36 acre.	R. P.	1 acre.	4 acre.	16 acre.	R. P.	1 acre.	4 acre.	16 acre.	R. P.	1 acre.	4 acre.	16 acre.
Re. 1·0	465	561	601	414	439	...	144	...	...	...	196	201	263	96	128	115	149
Rs. 1·5	370	455	480	321	359	...	118	...	...	...	160	160	202	77	104	93	108
„ 2·0	311	382	409	273	305	...	98	...	...	...	135	136	171	64	86	80	92
„ 2·5	268	333	361	242	277	...	86	...	...	...	116	120	153	56	76	70	84
„ 3·0	234	297	327	223	253	...	77	...	...	...	184	109	139	49	68	64	76
„ 3·5	209	269	298	206	232	...	69	...	...	...	94	98	130	43	61	58	69
„ 4·0	189	248	276	192	218	...	64	...	...	...	86	92	120	39	56	54	64
„ 5·0	157	207	240	168	196	...	54	...	...	...	72	78	107	34	48	46	56
„ 6·0	140	177	211	149	180	...	45	...	...	...	61	71	95	32	41	42	50

	Pabna, 1938.				Rajshahi, 1938.				Rangpur, 1938.				Tippera, 1938.			
Re. 1·0	214	323	334	141	...	104	139	...	146	91	132	130	128	347	372	372	288
Rs. 1·5	170	264	266	109	...	80	112	...	112	72	107	102	99	273	304	294	223
„ 2·0	143	220	226	92	...	69	94	...	97	60	92	87	84	229	253	251	189
„ 2·5	123	192	200	81	...	59	82	...	85	52	88	77	74	199	221	222	170
„ 3·0	108	173	180	76	...	52	74	...	80	44	70	71	69	175	199	201	155
„ 3·5	96	156	164	69	...	45	66	...	74	40	63	64	64	156	179	182	144
„ 4·0	89	141	152	64	...	42	61	...	69	30	58	60	60	143	164	169	135
„ 5·0	71	120	132	56	...	34	50	...	60	31	48	51	53	116	137	147	118
„ 6·0	61	102	117	49	...	30	44	...	53	26	41	45	46	95	117	130	104

TABLE (7·6)

Cost per Square Mile for different Levels of Variability.

Percentage Variability.	Deganga, 1937.					Dacca, 1938.				Murshidabad, 1938.				Mymensingh, 1938.			
	R. P.	1-acre.	4-acre.	16-acre.	36-acre.	R. P.	1-acre.	4-acre.	16-acre.	R. P.	1-acre.	4-acre.	16-acre.	R. P.	1-acre.	4-acre.	16-acre.
25 ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
50 ...	...	...	...	...	...	...	5·40	...	...	...	...	...	...	2·90	4·70	4·40	6·10
75 ...	...	...	...	...	...	...	3·20	...	...	...	4·80	5·40	...	1·50	2·50	2·20	3·00
100 ...	...	...	...	...	...	...	1·90	...	...	...	3·20	3·40	5·50	0·90	1·60	1·30	1·80
150 ...	5·30	...	...	5·90	...	...	...	...	...	...	1·70	1·70	2·60	0·10	0·60	0·40	0·90
200 ...	3·70	5·15	6·50	3·70	4·80	...	...	...	...	...	0·90	1·00	1·50	...	...	...	...
300 ...	2·11	2·97	3·47	1·68	2·08	...	...	...	...	...	...	0·30	0·80	...	...	...	...
400 ...	1·30	1·87	2·08	1·06	1·21	...	...	...	...	...	...	...	...	...	...	...	...
500 ...	0·90	1·25	1·40	0·83	0·72												

Percentage Variability.	Pabna, 1938.					Rajshahi, 1938.				Rangpur, 1938.				Tippera, 1938.			
25 ...	...	...	...	...	...	0·80	...	...	...	6·20	...	...	...	...	...	...	...
50 ...	7·90	...	...	5·80	...	3·10	5·10	...	7·00	2·60	4·80	5·10	5·40	...	...	...	...
75 ...	4·70	9·20	...	2·90	...	1·70	2·90	...	3·40	1·40	2·70	2·70	2·50	7·20	...	...	9·10
100 ...	3·30	6·10	7·30	1·70	...	1·10	1·80	...	1·90	0·90	1·70	1·60	1·50	5·70	7·00	...	6·4
150 ...	1·80	3·60	4·00	0·80	...	0 40	0·80	...	1·00	...	...	...	...	3·70	4·50	4·90	3·20
200 ...	1·10	2·30	2·80	0·20	...	...	0·30	...	0·50	...	...	...	...	2·50	3·00	3·10	1·80
300 ...	0·40	1·20	1·20	...	...	...	...	...	...	...	...	...	...	1·30	1·50	1·40	1·50
400 ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
500 ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

ENCLOSURE

EXPLORATORY CROP CENSUS IN BENGAL, 1938

REPORT ON THE WORK OF THE FIELD BRANCH

I. Charge and Superior supervision :—Babu Nihar Chandra Chakravarti, M.A., B.C.S., Secretary, Board of Economic Enquiry, Bengal, was in charge of the Field Branch as Supervisor during the whole period of work. Babu Amrita Lal Mukherjee of the Department of Agriculture, worked as Assistant Supervisor for the period 25. 7. 1938 to 10. 10. 1938. He was placed in charge of the work in the districts of Dacca, Mymensingh and Tippera. Instead of taking a second Asstt. Supervisor (Sub-Deputy Collector, who could not join in time) two of the initially trained inspectors, Babu Kanti Ranjan Banerji, M.A., and Babu Bijoy Krishna Das Gupta, B.A , B.L., were placed in charge of the works in Rajshahi, Rangpur, Pabna districts and Nadia, Murshidabad districts respectively, as Chief Inspectors. These two cost us Rs. 200/- per month as pay instead of about Rs. 350/- per month which a Sub-Deputy Collector would have cost us in pay and leave and pension contributions. We did also of course get 2 officer's work in place of one.

II. Inspection :—26 workers have been trained for Inspector's posts during this season. Of these 2 were ultimately given the rank of Chief Inspectors, one worked as Inspector, 7 as Deputy Inspectors and 10 as Assistant Inspectors. The other 6 could not be given Inspecting Officer's rank but worked as senior Investigators and occasionally were in temporary charge of Assistant Inspector's work. Of the above 8 have proved very successful, 5 have been found quite good, 11 others fairly good while the others are not up to the mark.

III. The disposition of the field staff was as follows :—24 in Mymensingh, 12 in Tippera, 12 in Rangpur, 12 in Pabna and 8 in each of the distiricts of Murshidabad, Pabna, Rajshahi, Nadia and Dacca, altogether 88. Besides the above, 28 other (local) persons were temporarily employed for an average period of about 10 days each for area copying work in the different district Head quarters. 28 of the Investigators also worked in area copying and in crop ditribution work in September, October and November, after completion of their work in field. 9 other

workers had to be appointed for field work temporarily in sick vacancies or in consequence of resignations. Altogether 125 appointments were thus made in the field work staff during the whole season. Of these, 28 were settlement experienced Amins or survey trained, 43 of the field staff proper and the 28 temporary hands for area copying were local men and the rest were recruited at Calcutta, mainly from persons who were expected to furnish trained recruits for Assistant Inspector's posts in future work. Of the above staff, 34 were Muslims and 9 of scheduled castes.

IV. Training :—The Inspecting staff and field staff recruited in Calcutta were given necessary training in 2 villages of Howrah Districts by the Supervisor between the 20th and 27th July 1938. The local recruits both in field work and in the area copying work were trained by the respective Inspecting officers. Training in Crop Schedule work was given by the Supervisor and Prof. Mahalanobis's Statistical Assistant, in the Laboratory.

V. Time :—The 125 field workers were paid for a total of 6345 days, distributed as follows :—

294 for training :—

52 Local Field workers @ 2 days	...	104 days.
45 Calcutta recruits @ 3 days	...	135 days.
28 Area copying @ 1 day ...	...	28 days.
27 Crop schedule workers @.1 day	...	27 days.
TOTAL		294 days.

1196 for journeys :—

To district and back including taking and making over papers etc.	...	104 days.
Transfer of 54 workers from one district to another in September for working new types of grids	...	162 days.
From one Union to another (including change of camp) for each worker and party (Each party had to shift camp once after every 4 or 5 days)	...	930 days.
TOTAL :—		1196 days.

101 days, (calculated from full and fractional days) lost for rains.

102 days, lost for illness.

253 days, lost for abandonment of work in areas for sudden floods, delay in grid lists reaching workers owing to postal difficulties and other similar reasons.

668 days, spent in area copying work (4·92 lakhs of plots) exclusive of—

169 days, when area work could not be done as Collectorates were closed.

463 days, were spent in crop schedule (distribution) work (2·71) lakh plots) excluding

115 days, when office was closed for holidays.

1546 days, were spent in complete enumeration work.

1438 days, were spent in random plot and grid survey work.

6345 days in all.

VI. Nature of work :—The field staff's work was of three kinds :—

(1) Area copying of plots at the district Head quarters ... ... 4·42 lakh plots.

(2) Crop Schedule work at H. Q. ... 2·71 lakh plots.

(Before completion of this work, the field branch office was closed and the remaining crop schedule work taken over by the Statistical Branch).

(3) Field work :—

(i) Complete enumeration of 824 Mouzas in 8 Thanas : 4,78,639 Plots with area—about 2,64,855 acres or 414 Sq. Miles.

(ii) Random plots of densities 3, 6, 9, 12 & 15 in 243 Mouzas : 2,540 Plots.

(iii) 1-acre grids of 2, 4, 6, 8 & 10 densities in 923 Mouzas : 6339 Grids—39,669 Plots.

(iv) 4-acre grids—2, 3, 4, 5 densities in 368 Mouzas : 1221 Grids—20,086 Plots.

(v) 16 acre grids of 2, 3 densities in 106 Mouzas : 328 Grids—18,956 Plots.

Total Field Survey :—5,59,890 Plots.

VII. The total cost in Field branch for work noted in Section VI has been Rs. 17,67,615/- exclusive of the contribution for the services of the Supervisor and Assistant Supervisor amounting to about Rs. 1200/- (after adjustment of Government's present claim of Rs. 2,079).

Details of the above are given below :—

Pay of Field workers : —

Primary workers for actual field work, ...	Paid for	
Area copying and Crop Schedule work	6345 days	Rs. 6,649/4/-
Field Inspecting Staff ...	1626 days	,, 3,332/7/-
H. Q. office staff (Field Branch)	880 days	,, 1,023/5/-
T. A. of Supervising, Inspecting and Field Staff ...		,, 4,238/4/6
Purchase of Maps (one set's price for Field work) ...		,, 651/9/9
Postage expenses ...		,, 171/12/-
Printing, Postage, Forms, Stationary, Misc-contingencies and pay for Menial staff ...		,, 1,610/4/9
Total Expenses (Field Branch)		Rs. 17,676/15/-

VIII. Progress and Outturn of work :—It would be seen from Section V above, that out of a total of 6345 days the primary workers were paid for, we got work for 5115 or 65% days only. 19% of the days (1196) were lost for journey, 9% of the days were lost for training and holidays and about 7% were lost for rains, illness and other reasons. The complete enumeration work of 4·78 lakh of plots was done in 1546 working days, which gives an average outturn of about 310 plots per working day.

The random plot and grid work of different sizes covered 81,251 plots, which were surveyed in 1438 working days giving an average otturn of just over 56 plots per day. This gives an overall average of 56 random plots, nine 1 acre grids, just over three 4 acre grids and a little more than one 16 acre grids per working day. This is also the general impression about outturn, subject to the random plots and grids being reasonably close, but such averages are palpably unreliable. Details are being worked out in the Statistical Branch.

IX. Difficulties of work :—The work started too late in the season. Full information about the working areas could not therefore be obtained before the starting of field work. The recruitment and training of staff and the organisation of work had all to be greatly hurried. The unusual floods of the year retarded progress to a great extent in many places. Journeys from village to village and often from plot to plot necessitated walking in knee and thigh deep water. The submerged 'ails' gave much trouble in identification. In many places the Bhadoi crop (Jute or Aus) had been harvested before workers went for work and as local people generally did not accompany workers in the watery fields, the latter had not unoften to find out what the previous crop was by searching for cut ends of jute or paddy in the fields under water, from a few inches to a couple of feet deep. In places where the land had been ploughed after the harvest of Jute or Aus for a second crop, hardly any trace of the previous crops was found and in such cases inaccuracies naturally crept in in noting the previous crop. The cadastral maps in Tippera Pabna, Dacca, Mymensingh and Murshidabad were mostly out of date and plot identification offered difficulties in that respect too. Local people in many places viewed the work with suspicion and such opposition had to be overcome by tactful discussions and lectures.

X. The efficiency and accuracy of work have been, as they were bound to be, prejudicially affected by the circumstances stated above. But even then, real errors would not I hope, be more than about 10% on the average. Working in proper season and with proper preliminary work and training it is hoped that it would be possible to keep down errors below 4 or 5%. I should add that the work in Deganga and Tarakeswar areas was nothing

nearly as difficult both from the point of view of work and workers, as has been the work in districts like Dacca, Mymensingh, Tippera, Pabna, Nadia and Murshidabad. Only the Rangpur area of this season was rather good in many respects but the awful mixing up of the plots gave a lot of trouble there too.

XI. Difficulties of Workers :—First in this matter comes the difficulty of finding accommodation. With many homesteads under water for the high floods, it was impossible for villagers to provide accommodation to workers. In consequence workers had to live in very bad huts, sometimes in boats and mostly at a considerable distance from the working villages. Good drinking water was rarely found, cost of food articles had risen considerably even when available. Rains coming down every now and then drenched them at times. The scorching sun of September passed over their head. Journeys from one camping place to another proved costly in most areas and I have known cases when, working in their density grid work single workers had to spent as much as Rs. 8/- in one month for cooli charge to taking his bedding, utensils and maps. The walking through water and mud for hours on end day by day was their ordinary routine. The Inspecting Officers suffered in the same way as the Investigators and I wish to place on record that but for the admirable courage, fortitude, and loyalty of the staff, lowpaid as they were, it would have been impossible for the work to be completed.

(Sd.) N. C. CHAKRAVARTI.
Supervisor.