REPORT ON BENGAL CROP SURVEY, 1943 - 44

Part I: Jute and Aus Paudy, 1943

by
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General Arrangements

A five-year scheme for the improvement of the annual estimate relating to the area under jute in Bengal (which was started in 1937 by the Indian Central Jute Committee and was financed jointly by this Committee and by the Government of Bengal) was completed in 1941. The Indian Central Jute Committee considered the technique of sample survey developed in the course of this work to be entirely satisfactory and recommended that it should be continued in future by the Government of Bengal. Early in 1942, Government however decided to discontinue the sample survey, but reversed this decision at later stage, and at the end of March 1942 asked me to proceed with the survey. As preparatory work takes about four months, the survey had to be carried out in 1942 without adequate preparation with the result that the efficiency of the work was appreciably lowered. In 1943 the decision to proceed with the survey was unofficially communicated to me in February. This however was not early enough. In the meantime most of the field and statistical staff had been disbanded with the result that out of a total field staff of 375 no less than 236 (or 63 per cent) were raw recruits without any experience of crop survey work. The position was even more serious in the Statistical Branch. Out of a total staff of 208 as many as 175(or 84 per cent) were new recruits. Not only this; preparatory work had to be done in a rush which seriously affected the quality of work.

2. There were other unforeseen difficulties. Since 1937 I had repeatedly urged year after year that the sample survey should be extended to the paddy crop but all my efforts proved futile for a long time. In 1943 sanction was given to include Aus paddy in the Jute Survey Scheme and arrangements were made accordingly. I persisted in my efforts to have the scheme extended to cover Aman paddy which has roughly three times the total outturn of Aus. I was unofficially asked to make arrangements for a survey of Aman paddy, and preparatory work for this purpose was started in April 1943, but in the middle of June I was asked by the Secretary, Agricultural Department to suspend this work. The scheme for the survey of Aman paddy was however revived at the end of July and formally sanctioned by the Department of Civil Supplies. in August 1943. These sudden changes of decision seriously

The Scheme for the survey of Aman paddy was however revived at the end of July and formally sanctioned by the Department of Civil Supplies in August 1943. These sudden changes of decision seriously dislocated our work; and we were obliged to get ready for the Aman survey at a time when field operations for Jute and Aus were in full swing. Bengal was at this time in the midst of an unprecedented food crisis. In view of the overwhelming importance of collecting reliable data for the Aman crop I decided to give greater attention to the preparatory work for the Aman survey which inevitably meant neglecting the crop cutting work on Jute and Aus to some extent.

3. The work in 1943 had to be done under great difficulties. There was a serious shortage of rice, and our staff often had great difficulties in obtaining supply of rice or other foodgrains; in certain areas they were literally faced with starvation, and work had to be often abandoned. Besides shortage of food there were an unusually large number of cases of malaria which were aggravated by the practical impossibility of securing quinine. Other diseases added to the difficulties. Two field units, one working in Jalpaiguir and the other in Tangail, resigned en in a body. Many workers had to be given long periods of leave on account of illness. Two investigators actually died while in service. Two check Inspectors, three Inspectors and 50 investigators resigned while one Inspector and 16 investigators had to be discharged for dishonest work. The quality of work naturally suffered appreciably. Apart from the acute food shortage and disease the whole province was in an active theatre of war and conditions were unsettled everywhere. Taking everything into consideration it is on the whole a matter of congratulation that the survey could be finished without more serious mishaps or even a complete breakdown.

Changes in the Design

4. The design of the survey was based on previous experience and statistical calculations. Earlier work has shown that for maximum efficiency the density or number of grids or sample-units per square mile should be adjusted according to the intensity of cultigation of the crop. The optimum density for each level of intensity was decided after

laborious calculations with different models. In previous years the work was arranged in the form of two independent interpenetrating sub-samples (called half-samples) in which the work in each sub-sample (or half sample) was done independently by one party. Although the method of sub-samples was retained, certain changes were introduced in 1943 with the object of increasing the statistical control and check on the reliability of the field work.

5. The position may be best explained in the following way. In previous years, within each sub-block exactly half the total number of grids or sample-units were enumerated by one field party (A) and the remaining half by the other field party (B). Thus in a sub-block containing say 100 grids or sample units, 50 grids were enumbrated by party (A) and the remaining 50 by party (B). The sub-sample of 50 enumerated by each of the parties (A) and (B) supplied two independent estimates of the average proportion of land under Jute. A comparison of these two independent estimates (each based on one sub-sample or half sample) showed to what extent the field work had been done under control. The results for two half-samples within each sub-block would not, of course, be identical, but would differ to some extent owing to sampling fluctuations. It is possible to calculate from theoretical considerations by just what extent the two independent estimates should differ. If the observed differences were found to conform to the expected values calculated from theory then the field work would be considered to have been done under statistical control, and the results would be accepted as genuine. If the differences between the two half-samples were too large then it would be reasonable to infer that the field work had not been done with sufficient accuracy. On the other hand, if the results agreed too closely then there would be strong reasons to suspect that the field staff had copied the records from one another. The method of interpenetrating half-samples thus supplied a two-way check.

The Use of Duplicated Grids

6. In 1941, this half-sample check showed that on the whole the work was done under ~~xxxx~~ satisfactory statistical control. Results between pairs of half-samples never agreed too closely showing that there had been no copying of the field records by one party from another. The difference was on the whole just what was to be expected; only in a small number of areas there was any reason to think that the work had not been done with sufficient care. In 1942 however the position was different. The design of the survey was identical with that in 1941, and yet the half-sample check showed too large discrepancies between the two sub-samples. This indicated that the field work in 1942 had not been done with anything like the same care as in 1941. This, of course, was not surprising in view of the fact that the whole survey had to be organized at very short notice, and also because of the difficulties arising from unsettled conditions in the country consequent on Japan's entry into war. However, the comparatively large discrepancies in the field work in 1942 indicated the need of strngthening statistical checks. In the half - sample method it would be noticed that, although the work is repeated by both the parties in each sub-block,the grids or sample-units are all independent so that no grid is common to both the parties. This method would thus indicate the lack of reliability of field work,if any, but would not give any information as to the causes. In 1943 we therefore decided to use a number of grids which would be actually enumerated in duplicate by both the partie . We did this partly to study in greater detail the causes of discrepancy in field work, and also ~~to~~ detect,if possible,which party was more to blame.

The Design of the Survey

7. The province (excluding Darjeeling district,Hill Chittagong, South Chittagong and Contai,forest areas in Sundarbans etc.) was divided into 53 large units or blocks of about 1500 square miles each in area, and each consisting of a number of complete thanas so that no thana fell in more than one block. Each Block was divided into from 5 to 9 sub-blocks. These sub-blocks had either a size of about 75 square miles

in area or of about 100 square miles; the former was used in regions of comparatively greater density of cultigation of jute. Within each Block a number of these sub-blocks were picked up at random. The total number of sub-blocks included for survey in the whole province was 329, with 6.? sub-blocks per Block on an average.

8. Within each sub-block a certain number of sheets (a sheet is a separate ~~print~~ piece of the cadastral survey map covering a complete or a portion of a village) was selected at random. The number or density of sheets per square miles in a sub.block was settled in accordance withthe intensity of cultivation of jute. Six levels of intensity of cultivation were recognised for this purpose with the proportion of land under jute: (A) less than one per cent; (B) between one and 8 per cent; (C) between 8 and 15 per cent; (D) between 15 and 18 per cent; (E) between 18 and 23 per cent; and (F) above 23 percent. For each level of intensity of cultivation there is a particular density of sheets. The total number of sheets to be included in the survey in each sub-block is obtained by multiplying the total area of the sub-block by the appropriate density. For example, if the area of a sub-block is 130 square miles and the level of jute bultivation is say eleven per cent then the assigned density for (C) level being 0.72, the total number of sheets to be selected at random within this sub-block would be 81.

9. It may be mentioned at this stage that the field staff was divided into two groups (A) and (B), as in previous years, to provide statistical controls and cross-checks. In 214 out of 329 sub-blocks arrangements were made for portions of the field work being done by both the parties. For the remaining 115 sub-blocks work was done by either the (A) or the (B) party. Within each sub-block in which work was done by both the parties (which for convenience of reference we shall call "duplicated" sub-blocks) arrangements were again made for having the work done by both the parties on a certain proportion of the sheets, the work on the remaining sheets being done by only a single party. The distribution of the density of sheets of different types by levels of intensity of jute cultivation is shown in Table (1).

Table (1) Distribution of density (number per sq. miles) of sheets By levels of intensity of cultivation of jute.

Levels	Intensity of Jute cultivation	Number of Sub-blocks	Coverage on sq. miles	Density of Sheets				
				Compulsory		Optional	Total	
				Duplicated	Single		Actual	Effective
(1)	(2)	(3)	(4)	(5)	(6)	(6)	(7)	(8)
(A)	Below .01	83	100	0.20	0.10	0.10	0.40	0.60
(B)	.01 - .08	113	100	0.20	0.10	0.10	0.40	0.80
(C)	.09 - .15	49	100	0.36	0.18	0.18	0.72	1.08
(D)	.16 - .18	34	100	0.44	0.22	0.22	0.88	1.32
(E)	.19 .23	24	75	0.48	0.24	0.24	0.96	1.44
(F)	.24 & above	26	75	0.52	0.26	0.26	1.04	1.56
		329		0.28	0.14	0.14	0.56	0.84

10. In this Table (1), column (1) gives the alphabetical symbol of the level; col.(2) the range of intensity of jute cultivation; col.(3) the number of sub-blocks having this range of cultivation; and col.(4) the approximate coverage or area of each sub-block in square miles. The next five columns (5) - (9) show the density of sheets at each level of cultivation by different types of field work. Column (5) gives the density (or number per square mile) of "duplicated" sheets, that is, of sheets on which work was done by both parties; col.(6) the density of "single" sheets on which work was done by either the (A) or the (B) party. These duplicated or single sheets were compulsory in the sense that all workers were expected to complete the allotted work on such sheets. Besides these compulsory "sheets" a certain proportion of "optional" sheets were also given, and the investigators were asked to try to do as many of these optional sheets as possible. The density of such optional sheets is shown in col.(7). The next col.(8) gives the actual density of sheets at each level of cultivation, while the final col.(9) gives the effective or total density of sheets covered in the field survey taking into consideration work done by both parties. For example, at level (C) with an intensity of cultivation between 9 and 15 per cent we find that the compulsory duplicate density was 0.36 in col.(5); the density of single as well as optional sheets was 0.18 each in cols. (6) and (7). Adding 0.36, 0.18 each in cols. (6) and (7). Adding 0.36, 0.18 and 0.18 the actual density of sheets at this level was 0.72 as shown in col.(8). Among these, 0.36 is however duplicated, that is, work is done on these sheets by both the parties; adding 0.36 to 0.72 we then get 1.08 as the effective or working density or sheets as shown in col.(9).

Table (2). Distribution of number of sheets and number of Grids by types of Enumeration.

Sub-Blocks		Number of Sheets				Number of Grids			
			Non-	Total			Non-	Total	
Type	Number	Duplicated	Duplicated	Actual	Effective	Duplicated	Duplicated	Actual	effective
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Duplicated	214	5707	4280	9987	15694	11414	24254	35668	47082
Single	115	-	4090	4090	4090	-	12270	12270	12270
Total	329	5707	8370	14077	19784	11414	36524	47938	59352

11. The next Table (2) gives in a summary form the distribution of the number of sheets and number of grids by types of sub-blocks; "duplicated" on which work was done by both the parties, and "single" on which work was done by either the (A) or the (B) party. As already stated, work was done by both the parties (A) and (B) in 214 duplicated sub-blocks, and by only one of the parties in 115 single sub-blocks. From col.(3) we notice that work was done in 5707 sheets by both the parties; and from col.(4) that work was done by only one of the parties in 4280 sheets in duplicated sub-blocks and 4090 sheets in single sub-blocks. The total number is given in col.(5), and the effective number in col.(6).

12. The next step was the allocation of grids or sample units to sheets. Four grids were located at random in each duplicated sheet out of which two grids were to be enumerated by both the parties, and one each by each of the parties; each party thus enumerated three grids on each sheet. Single sheets had only three grids which were all enumerated by either party (A) or party (B). From col.(7) of Table (2) it would be noticed that the number of "duplicated" grids was 11,414 and the number of "single" grids 36,524. The actual total number of grids was thus 47,938; adding to these the 11,414 grids on which work was duplicated, the total number og grids enumerated was 59,352.

The Preparatory Work

13. Unofficial information was received from Professor Todd (Special Officer, Jute) early in February 1943 that the Scheme for the Jute-Aus Survey had been approved in principle by Government. The preparatory work in the Laboratory was started immediately, and the design of the sample survey was made ready by the end of February. Mauza maps were collected from the different districts, and the sample grids were distributed among the different mauza sheets in accordance with the new design. Grids were then selected at random with the help of the co-ordinatograph, and field lists

were prepared in the usual way. Owing to the late start, such preparatory work had to be continued till practically the end of May 1943. As work had to be done under high pressure, it was not possible to finish the measurement of the area of individual plots before handing over the field lists to the Field Branch. The work of measuring the area of individual plots had to be therefore done at a later stage. This involved a good deal of additional labour which could have been easily saved if the preparatory work could have been started earlier.

14. The first serious difficulty in organizing the Field Branch was the lack of a Supervisor. Every year up to 1941 the services of a Deputy Collector had been placed at our disposal for this purpose. In 1942, in spite of my repeated efforts, I had failed to get the help of a Deputy Collector; and had, therefore, appointed as Field Supervisor, Mr. Dhirendra Mohon Ganguli, an officer of the Indian Central Jute Committee who had worked as Assistant Superviser in previous years. In 1943 I again wrote to Government repeatedly for the services of a Deputy Collector but to no avail. Mr. D. M. Ganguli had also reverted to his post, but by the courtesy of Mr. B. B. Das Gupta, Secretary, Indian Central Jute Committee, Mr. Ganguli's services were again placed at our disposal for the survey in 1943 in which he worked as Supervisoer. For this we are truly thankful to the Indian Central Jute Committee.

15. I must also acknowledge our deep debt of gratitude to the authorities of the Visva-Bnarati for lending us the services of Mr. Santipriya Bose, B. Sc., Agri (Wales), Rabindranath Tagore Fellow of Sriniketan, who worked as Asstt. Supervisor from 1st April to 31st December 1943. Mr. Bose did his work with great success and his assistance was of great help to us. Mr. Pranay Kumar Chatterjee M. Sc., one of the workers of the Statistical Laboratory with several years experience of the crop survey scheme, worked as another Assistant Supervisor.

16. Recruitment and Training of the Field Staff : Advertisements for the field staff were issued in newspapers in March 1943, about 700 applications were received out of which 225 candidates were selected for preliminary field training. Eight camps were opened at (1) Naogaon, (2) Serajgunj, (3) Memari, (4) Pabna, (5) Boso, (6) Dhaniakhali, (7) Pongaon, and (8) Daulatpur for this purpose. More than 50 candidates resigned while under training, and 19 did not turn up for the field work although appointment letters had been issued to them. Letters

In the meantime the forms for the field enquiry and detailed instructions were prepared and printed. The work was voluminous as about 75,000 different forms had to be printed.

18. Five batches of workers were also sent to Boro (Sundarbans) paddy growing districts for gaining some experience of crop cutting work which was carried out in 24 police station of Dacca, Tipperah, and Mymensingh and Pabna districts. The work extended from the third week of April to the first week of May during which about 4 0 sample-cuts were secured.

Organisation of the Field Units.

19. The field staff was organized in the form of parties or units each of which consisted of one Inspector, one Special Investigator, and from four to six ordinary Investigators. The whole province was divided into 22 Blocks, and each Block was further divided into from 11 to 18 sub-blocks. From 3 to 4 field units worked in each Block. Within each Block a central Block camp was opened. Each Block camp was in charge of a camp clerk and a camp Investigator. The Block office as also the field units working in each block were placed under a Check Inspector who was in administrative charge of the work within the Block. The field units working within each Block kept in touch with the Block office where they came from time to time to deposit their maps and forms and to take delivery of other maps and forms as necessary. As most of the field units had to work in from 8 to 12 sub-blocks, it would have been difficult for them to carry all the maps and forms with them all the time. The Block offices were also convenient in making payments to the field staff and in maintaining contact between the field units and the head quarters staff in Calcutta.

20. In 1943 there were altogether 44 field units; ten of these units worked in two different Blocks and each of the remaining 34 in only one Block. In each field unit the Investigators did the actual enumeration work while the Inspector checked their work. In each sub-block work was usually done from a single camp at which the whole party stayed together. The Inspector was thus in continuous touch with the Investigators. When the Inspector was absent or ill the Special Investigator took charge of the unit.

21. The Block offices (each in charge of a Block clerk and a Block Investigator) were opened sometime before the actual beginning of the

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Table 3. Distribution of Investigator days by Blocks.

Block No.	Name of District	No. of Sub-blocks	No. of parties	Period of Survey	Enumeration days	Working Days	Pay Days
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1.	Barisal and Faridpur	21	4	May 21 - Aug 13	829	1112	1350
2.	Faridpur, Dacca and Nadia	16	2	" 27- Aug 24	568	764	1140
3.	Dacca	11	3	" 21-July 12	540	592	775
4.	Tippera, Noakhali and Chittagong	15	3	" 20 -Sept 17	512	744	1140
5.	Pyramsingh	14	2	" 20 -Aug 15	686	852	1062
6.	Mymensingh and Dacca	12	3	" 27 - " 24	801	1032	1160
7.	Rajshahi	11	3	" 27 - " 5	558	692	715
8.	Pyramsingh and Dacca	12	4	" 27 " 7	564	702	900
9.	Bogra, Rajsahi, Dinajpur and Rangpur	17	2	" 26 " 26	765	963	1150
10.	Rangpur and Jalpaiguri	16	2	" 27 Sept 7	679	820	1080
11.	Jalpaiguri and Rangpur	11	2	" 25 " 1	536	752	900
12.	Dinajpur	14	2	" 25 -Aug 31	782	873	990
13.	Maldah, Rajsahi and Dinajpur	16	2	" 27 -Sept 4	653	812	990
14.	Murshidabad, Nadia and Rajsahi	15	2	" 28 -Aug 17	655	781	730
15.	Nadia and Jessore	13	2	" 26 -Sept 8	768	915	910
16.	Khulna and Jessore	17	2	" 28 -Aug 21	770	940	1000
17.	24 Parganas Khulna and Jessore	19	2	" 29 " 26	690	878	970
18.	24 Parganas Howrah and Hooghly	20	2	" 30 " 30	838	1208	1350
19.	Midnapore	19	3	July 19 -Sept 17	539	805	810
20.	Burdwan and Hooghly	13	2	" 17 " 11	512	634	780
21.	Birbhum and Burdwan	12	2	" 22 " 22	492	623	750
22.	Burdwan, Midnapur and Hooghly	14	2	" 19 " 19	744	956	1200
		537	54	May 20 -Sept 22	14461	18132	21635

28. The Inspectors checked about eleven per cent of all grids, and consumed a total of 3,712 pay-days for their work. The Check Inspectors themselves checked about 1,300 grids in 109 sub-blocks, and spent 1,362 pay-days for their work. The Camp Clerks and Camp Investigators consumed 2,137 gross pay-days for their respective work. The total number of worker-days (excluding peons) spent in the Jute-Aus survey was thus 25,853 pay-days or roughly one thousand man-months. This would give some idea of the total volume of the work in the Field Branch.

29. I have already stated that although the Jute-Aus Survey Scheme had been sanctioned in the first instance it was later merged with the Aman Survey Scheme. A grant of Rs.,34,000 was sanctioned by the Government of Bengal in the form of a block grant to the Indian Statistical Institute to cover all expenses inclusive of dearness allowance. The accounts for both the Schemes are therefore being kept jointly, and it is not therefore necessary to mention any thing separately at this stage.

25. In some of the sub-blocks in East Bengal the plots were submerged by flood water before the field survey could be completed. Cadastral village maps were also missing in certain sub-blocks, which made it necessary to abandon a certain number of compulsory grids. The field staff made every effort to procure locally the missing village maps and in many cases they were successful; otherwise a larger number of compulsory grids would have remained unenumerated.

26. About 63,500 grids or sample-units had been made ready from the Laboratory, out of which 50,400 were actually enumerated and the rest were abandoned because of the rise of flood water, or for lack of maps or want of time. About 13 per cent of the total number of grids were thus abandoned. As already mentioned, about 20 per cent of the allotted grids were optional for which no extra time had been provided in the field programme. The greater part of the abandoned grids were optional so that not much harm was done.

27. Table (3) shows the distribution of investigator-days by Blocks. Column (1) gives the serial number of the Block; col. (2) the name of the district; col. (3) the number of sub-blocks; and col. (4) the number of field units or parties; and col. (5) the actual period of area survey in each block. The total number of actual enumeration-days, that is, the number of days on which enumeration work was done (one investigator enumerating for a day constituting one enumeration-day) was 14,401. The number of working days, that is, the number of days on which work in connexion with the survey was actually done on the field is given in col. (7), and was 18,132 for the province as a whole. Finally the number of pay days, that is, the number of days for which payments were made to the Investigators is shown in col. (8). The total number of pay days was 21,635. This of course includes the period of training, leave on full pay, as well as the time taken for moving from one area to another. It would be noticed that out of this total 21,635 pay days 14,401 were actually utilised for direct or productive enumeration work. Even in the case of Investigators the actual effective number of days is thus only about two-thirds of the total number of days for which the staff was paid.

Table 3. Distribution of Investigator days by Blocks.

Block No.	Name of District	No. of Sub-blocks	No. of partie	Period of Survey	Enumera-tion days	Working Days	Pay Days
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1.	Barisal and Faridpur	21	4	May 21 - Aug 13	829	1110	1350
2.	Faridpur, Dacca and Nadia	16	2	" 27- Aug 23	655	784	1140
3.	Dacca	11	3	" 31-July 12	543	592	775
4.	Tippera, Noakhali and Chittagong	15	3	" 20 -Sept 17	612	744	1170
5.	Mymensingh	14	2	" 20 -Aug 15	636	852	1040
6.	Mymensingh and Dacca	12	3	" 27 - " 14	501	1032	1160
7.	Rajshahi	11	3	" 27 - " 5	503	642	710
8.	Mymensingh and Dacca	12	4	" 27 " 7	544	702	950
9.	Bogra, Rajsahi, Dinajpur and Rangpur	17	2	" 26 " 26	765	963	1150
10.	Rangpur and Jalpaiguri	16	3	" 27 Sept 7	670	820	1080
11.	Jalpaiguri and Rangpur	11	2	" 25 " 1	365	732	930
12.	Dinajpur	14	2	" 25 -Aug 21	782	873	990
13.	Maldah, Rajsahi and Dinajpur	16	2	" 27 -Sept 4	815	822	990
14.	Murshidabad, Nadia and Rajshahi	15	2	" 28 -Aug 17	655	761	730
15.	Nadia and Jessore	13	2	" 30 -Sept 8	768	915	910
16.	Khulna and Jessore	17	2	" 28 -Aug 21	779	9[illegible]	1[illegible]0
17.	24 Parganas Khulna and Jessore	19	2	" 29 " 26	693	878	970
18.	24 Parganas Howrah and Hooghly	20	2	" 30 " 30	628	12[illegible]6	1300
19.	Midnapore	13	5	July 19 -Sept 17	555	555	800
20.	Burdwan and Hooghly	13	2	" 19 " 11	512	634	760
21.	Birbhum and Burdwan	12	2	" 22 " 22	432	625	750
22.	Burdwan, Midnapur and Hooghly	14	2	" 19 " 10	744	8[illegible]6	1[illegible]0
		337	54	May 20 -Sept 22	14461	18132	21635

28. The Inspectors checked about eleven per cent of all grids, and consumed a total of 3,712 pay-days for their work. The Check Inspectors themselves checked about 1,300 grids in 1.9 sub-blocks, and spent 1,302 pay-days for their work. The Camp Clerks and Camp Investigators consumed 2,137 gross pay-days for their respective work. The total number of worker-days (excluding peons) spent in the Jute-Aus survey was thus 2,,653 pay-days or roughly one thousand man-months. This would give some idea of the total volume of the work in the Field Branch.

29. I have already stated that although the Jute-Aus Survey Scheme had been sanctioned in the first instance it was later merged with the Aman Survey Scheme. A grant of Rs.,34,000 was sanctioned by the Government of Bengal in the form of a block grant to the Indian Statistical Institute to cover all expenses including of dearness allowance. The accounts for both the Schemes are therefore being kept jointly, and it is not necessary necessary to mention any thing separately at this stage.

Results of the Area Survey

30. I shall now give the results of the area survey of Jute and Aus. Preliminary estimates of the acreage under these two crops were submitted earlier. These have been now revised and the final estimates are given below :

31. Area under Jute : 1945 . The estimated acreage under jute in 1945 is shown in attached Table (4) in which col. (1) gives the serial number and name of the district, col. (2) the total geographical area in thousand acres ; Col. (3) the total number of grids or sample-units actually surveyd. The number of "duplicated" Police Station or sub-blocks in which enumeration work was done by both parties (A) and (B) is shown in col.(4). The estimated acreage (together with the standard error) based on Sample (A) in these duplicated sub-blocks is given in col.(5.1) and the corresponding percentage variability or error (which is the percentage ratio of the standard error of the estimated acreage divided by the acreage itself and is denoted by the symbol P.V.) is shown in col.(5.2). In the same way, the estimated acreage with standard with error based on the second Sample (B) in the duplicated sub-blocks is given in col. (6.1); and the corresponding percentage error (P.V.) in col. (6.2). The total number of "single" or "non-duplicated" Police Station is shown in col.(7); and the estimated acreage and percentage error based on the third Sample (C) in cols. (8.1) and (8.2) respectively Finally, the total number of sub-blocks covered in the survey (inclusive of both "duplicated" and "non-duplicated") is shown in col.(9); and the estimated acreage (with standard error) on all three samples in col.10.1), and the corresponding percentage error (P.V.) in col.(10.2)

32. It would be noticed that the percentage error (or percentage) variability) of the mean acreage for individual districts varied quite widely. It was naturally smallest and only 1.3 per cent for Dyamsingh (which has the largest area under Jute) as seen in col. (10.2) for the pooled estimate; and it varied from about 8 to 14 per cent for the heavier districts like Dacca (8.1 per cent), Faridpur (8.2 per cent) Jessore (8.7 per cent), Pabna, (14.7 per cent), Rangpur (7.7 per cent) and Tipperah (12.4 per cent) in each of which the acreage was in excess of a lakh of acres.

55. The provincial estimate based on the sample survey is 27.99 ± 0.78 lakhs of acres. The official forecast of 21.44 lakhs of acres is much lower and is in defect of the sample estimate by 6.11 lakhs of acres or about 22 percent of the sample estimate. The standard error of the sample estimate is about 2.8 per cent; at odds of 20 to 1, the true value should lie within any six per cent of the sample estimate. So far as the sample survey is concerned, I am aware that the quality of field work in 1943 was not entirely satisfactory. But as far as I can judge the estimates should not be out by anything like the gap of 22 per cent between the official and the sample estimates.

54. It is worth while recalling in this connexion that official forecasts of the area under both Jute and paddy in Bengal have been long known to be largely underestimates. For paddy, for example, a detailed comparison shows that official estimates have been on an average 25 per cent less than corresponding contemporaneous estimates based on Settlement records. The reasons for such underestimation are well known. In every country it has been found that crop acreage and outturn estimates are usually made on the low side partly because in matters of supply of basic food or cash crops people usually think it better to err on the safe, that is, or the more conservative side; and partly because short crops are likely to increase or at least maintain prices. Agriculturists all over the world are therefore likely to give pessimistic forecasts about crop outturn. The investigators are probably influenced, either consciously or unconsciously, by this universal conservatism. In any case, crop estimates are almost always found to be definitely conservative.

56. The history of Jute forecasts in Bengal is also of interest in the present connexion. It would be remembered that an attempt was made in 1939 to compile a complete record of all plots under Jute in Bengal. The effort however proved completely futile and the records were so fantastically exaggerated that the acreage under Jute in certain regions had exceeded the total geographical areas and Government decided to destory the records. In 1940 much more careful arrangements were made and an estimate of the acreage under Jute was prepared by the method of complete enumeration. In 1941 the official forecast was based on this complete enumeration and probably reached as high a precision as can be attained by this method in practice. The result of the sample survey in the same year (1941) agreed within two or three per cent with the official

official forecast showing conclusively the validity of the sample surveys.

36. In 1942 the official estimate was smaller than the sample estimate by about ten per cent. In 1943 the gap has further widened, and the official estimate is in defect by about 22 per cent. The official estimates are thus steadily diverging from the sample estimates by increasing amounts and are on the more conservative side. This, however, is on the whole just was what one would expect from general considerations.

The Sample Estimate of Acreage in 1942.

37. As regards acreage under Jute in 1942 I am giving below a comparison of the sample estimate with figures supplied by the Secretary, Indian Central Jute Committee. At my request, the Secretary, Indian Central Jute Committee, in his D.O.No.357/43 dated 23rd November 1943 gave the following "estimate of the jute crop of 1942-43 based on figures of the jute trade".

	Lakhs of bales
Mill purchase	78.2
Export	13.1
Village consumption	6.0
Increase in stocks of ballers, dealers and growers.	1.5
Crop of 1942-43	96.8

I may mention here that the two biggest items, namely, 'Mill purchase' (78.2 lakhs of bales) and 'export from India', (13.1 lakhs of bales) are actual gt figures, while the estimated village consumption of 6 lakhs of bales is based on an actual enquiry made by the Indian Central Jute Committee.

38. The above estimates of 96.8 lakhs of bales includes crop grown in Bihar (5.6 lakhs of bales), Assam (0.4 lakhs of bales), Orissa (0.8 lakhs of bales), and the Native States of Bengal (0.5 lakhs of bales) with a total of 10.5 lakhs of bales grown outside Bengal (as given in the Final Review of the Jute Crop for the season 1942-43). This leaves us with a to outturn in Bengal of 86.3 lakhs of bales. The average rate of yield of jute in 1942-43 has been given as 2.96 bales per acre in the Final Jute Forecast issued by the Government of Bengal. The acreage in Bengal on the basis of trade figures may be thus taken to be (86.3 lakhs of bales divided by 2.96 =) 29.2 lakhs of acres. This differs from the sample survey estimate by just about 2 per cent.

39. But

Acreage under Jute (1943) by districts with Percentage variability.

Name of District (1)	Total area in Thousand acres (2)	No. of Grids surveyed (3)	No. of double Grids (4)	Area under Jute in Thousand acres: Sample (A) Acreage ± S.E (5·1)	P.V. (5·2)	Sample (B) Acreage ± S.E (6·1)	P.V (6·2)	Ratio of Sample A/S (7)	Sample (C) Acreage ± S.E (8·1)	P.V. (8·2)	No. of pl. (9)	Ratio Sample A/S Acreage ± S.E (10·1)	P.V (10·2)
1 Bakarganj	2543	2226	13	22·3 ± 1·8	57·4	41·6 ± 6·7	164·1	6	79·6 ± 20·9	111·6	19	47·1 ± 3·4	6·5
2 Bankura	1694	1265	7	1·0 ± 0·2	30·0	3·6 ± 1·2	115·4	1	0·7 ± 0·0	0·0	8	2·1 ± 1·4	66·7
3 Birbhum	1116	1203	5	1·2 ± 0·4	22·2	3·9 ± 2·9	73·4	3	0·6 ± 0·0	-	8	1·8 ± 1·0	55·6
4 Bogra	946	1862	6	100·5 ± 34·3	34·1	76·4 ± 37·7	49·4	3	74·4 ± 8·8	11·8	9	83·7 ± 17·2	20·5
5 Burdwan	1721	2059	9	32·0 ± 14·0	43·8	19·7 ± 4·1	20·9	5	0·0 ± 0·0	-	14	16·6 ± 4·9	29·5
6 Chittagong	1645	285	-	2·0 ± 2·6	130·0	2·0 ± 2·6	130·0	15	2·0 ± 2·6	130·0	5	2·0 ± 2·6	130·0
7 Dacca	1753	3717	12	302·2 ± 59·6	19·7	288·5 ± 41·8	14·4	6	214·0 ± 7·7	9·3	18	268·3 ± 24·4	9·1
8 Dinajpur	2556	2946	13	101·0 ± 26·8	26·5	101·7 ± 26·3	25·8	5	88·7 ± 31·6	39·2	18	97·5 ± 17·0	17·4
9 Faridpur	1505	2260	10	244·4 ± 15·2	6·2	223·9 ± 15·6	6·7	15	193·7 ± 69·4	35·5	15	220·7 ± 18·6	8·2
10 Hooghly	770	851	6	15·6 ± 5·3	34·0	20·5 ± 25·3	123·5	3	27·4 ± 2·5	9·1	9	21·1 ± 8·7	41·2
11 Howrah	342	769	2	4·1 ± 0·9	22·0	5·2 ± 1·3	24·8	11	10·8 ± 1·7	15·7	3	6·7 ± 0·8	11·9
12 Jalpaiguri	1847	1598	7	35·6 ± 10·7	30·1	83·7 ± 15·1	18·1	4	65·6 ± 3·3	5·0	11	61·8 ± 6·3	10·2
13 Jessore	1571	3376	12	59·7 ± 23·6	12·5	209·2 ± 16·8	8·0	5	140·5 ± 32·4	23·1	17	182·1 ± 14·5	8·0
14 Khulna	1592	2088	9	27·5 ± 9·7	32·9	27·9 ± 8·6	31·4	5	50·3 ± 25·7	47·2	14	26·4 ± 9·6	36·4
15 Maldah	1275	1377	7	51·8 ± 12·2	23·6	171·4 ± 49·8	20·2	2	34·8 ± 9·8	28·2	10	53·6 ± 17·4	32·5
16 Midnapur	3375	3206	14	3·7 ± 1·3	35·1	5·4 ± 1·7	30·9	7	12·6 ± 11·5	91·3	21	7·2 ± 3·9	53·4
17 Murshidabad	1367	1529	7	68·2 ± 14·0	20·5	55·8 ± 13·7	24·5	4	52·5 ± 9·9	18·9	11	58·5 ± 7·2	12·5
18 Nyamen Singh	3963	7073	21	758·1 ± 57·3	4·9	712·5 ± 33·3	4·7	9	683·6 ± 5·2	39·5	30	719·0 ± 16·8	2·3
19 Nadia	1811	1929	9	89·4 ± 15·8	19·7	100·5 ± 17·9	17·7	5	90·7 ± 43·9	47·7	14	90·5 ± 16·7	18·4
20 Noakhali	894	704	2	50·1 ± 5·7	11·4	49·2 ± 21·5	43·6	3	12·6 ± 5·1	15·1	5	38·5 ± 7·6	19·6
21 Pabna	1164	4479	7	105·1 ± 35·4	33·7	107·1 ± 31·7	29·6	4	153·9 ± 22·1	14·4	11	123·5 ± 17·5	14·2
22 Rajshahi	1111	1476	7	47·9 ± 13·5	31·5	56·2 ± 12·1	21·5	3	109·4 ± 15·6	14·3	10	67·5 ± 8·0	11·9
23 Rangpur	2388	4773	12	247·1 ± 30·5	11·8	247·9 ± 33·2	13·4	7	300·5 ± 42·7	14·2	19	270·2 ± 20·7	7·7
24 Sibsagar	1608	2617	7	144·8 ± 43·1	26·2	155·5 ± 36·8	23·7	5	245·5 ± 58·5	19·0	12	204·1 ± 25·3	12·4
25 Sundarbans	2176	2668	10	55·1 ± 31·4	33·0	87·6 ± 34·1	39·0	8	149·6 ± 71·7	146·6	15	122·8 ± 23·5	19·1
Total	43646	57352	204	1590·0 ± 112·6	4·	2756·9 ± 121·5	4·4	115	2732·8 ± 177·9	6·5	329	2754·8 ± 78·2	2·8

39. But the agreement would be still closer if we take seed requirements into consideration. According to an enquiry made by the marketing staff of the Indian Central Jute Committee (Report on the Marketing and Transport of Jute in India, Table XX) about 4 per cent of the total land under jute is used for growing seeds. On this basis (4 per cent of 28.2 lakhs of acres=) 1.2 lakhs of acres would be the requirement for growing jute seeds. The total acreage in Bengal on the basis of trade figures would thus come to 29.2 + 1.2 = 30.4 lakhs of acres. This is only 1 per cent higher than the estimate obtained by the method of sample survey, but 12 per cent higher than the official estimate based on figures collected through the Jute Regulation staff. The sample survey (which professes to give an estimate with a margin of error not exceeding about 5 per cent) thus appears to have been entirely successful in supplying a reliable estimate of the acreage under jute in Bengal in 1942-45.

40. I am aware that the figures supplied by the Indian Central Jute Committee are not considered reliable by the Agricultural Department of the Government of Bengal. I have no direct knowledge in this matter, and I am unable to offer any opinion, this way or that, as to the reliability of the figures supplied by the Indian Central Jute Committee. I am giving the above comparison for just whatever it may be worth.

Area under Aus Paddy : 1945.

41. The estimated acreage under Aus paddy is shown by districts in Table (5) in which the arrangement of the columns is exactly similar to that for the acreage under Jute shown in Table (4). Column (1) gives the name of the district; col. (2) the geographical area in thousands of acres and col.(3) the total number of grids surveyed (which of course, is the same as for the Jute survey). The number of "duplicated" and "non-duplicated" and, total number of sub-blocks surveyed are shown, as in Table (4), in cols. (4), (7) and (9) respectively. The estimated acreage in thousands of acres based on the first Sample (A) in duplicated sub-blocks is given in col. (5.1); the corresponding estimate based on the second Sample (B) in the same sub-blocks in col. (8.1); and the estimated acreage based on a third Sample (C) in non-duplicated sub-

Table 5: [illegible] Acreage under [illegible] (19[illegible]) [illegible] with Percentage variability.

	Name of District	Total Area in thousand	Total no. of Grids Surveyed	No. of defined P.S.	Sample A Acreage ± S.E.	Sample A P.V	Sample B Acreage ± SE	Sample B P.V	No. of Single P.S.	Sample C Acreage ± SE	Sample C P.V	Total no. of PS	All samples Acreage ± SE	All samples P.V
	(1)	(2)	(3)	(4)	(5.1)	(5.2)	(6.1)	(6.2)	(7)	(8.1)	(8.2)		(10.1)	(10.2)
1	Backergunj	2563	2226	13	528.6 ± 90.8	10.6	522.2 ± 63.4	12.1	6	291.7 ± 124.3	42.6	19	472.1 ± 58.8	12.0
2	Bankura	1694	1265	7	92.3 ± 18.6	20.2	5.8 ± 1.9	32.8	1	133.1 ± 131.1	98.5	8	59.3 ± 44.2	71.5
3	Birbhum	1716	1203	5	3.6 ± 2.7	75.0	9.7 ± 5.7	58.7	3	0.0 ± 0.0	–	8	4.1 ± 2.1	50.9
4	Bogra	912	1362	6	126.0 ± 38.5	20.7	175.0 ± 60.0	34.3	3	154.2 ± 69.9	45.3	9	171.7 ± 34.4	20.0
5	Burdwan	1731	2050	9	72.0 ± 41.2	57.3	103.2 ± 40.2	37.1	5	10.9 ± 1.4	12.3	14	65.0 ± 14.0	31.6
6	Chitagong	1645	285	–	467.0 ± 44.9	9.6	467.0 ± 44.9	9.6	5	467.0 ± 44.9	9.6	5	467.0 ± 44.9	9.6
7	Dacca	1753	3717	12	427.7 ± 79.6	18.6	394.6 ± 64.3	16.3	6	337.3 ± 91.0	27.0	18	386.6 ± 45.3	11.9
8	Dinajpur	2556	2940	13	392.2 ± 40.6	10.4	314.9 ± 49.6	15.7	5	446.8 ± 185.1	41.4	18	324.1 ± 65.2	20.1
9	Faridpur	1505	3260	10	276.5 ± 33.7	12.2	285.6 ± 37.0	13.0	5	229.4 ± 35.5	15.5	15	263.8 ± 20.5	7.8
10	Hooghly	730	851	6	21.5 ± 13.3	61.9	435.5 ± 17.3	39.8	3	52.3 ± 23.1	44.3	9	59.1 ± 10.6	27.1
11	Howrah	342	764	2	4.5 ± 3.2	71.2	20.2 ± 23.9	143.1	1	5.8 ± 3.0	51.7	3	10.2 ± 5.6	54.9
12	Jalpaiguri	1842	1593	7	57.5 ± 22.5	38.5	79.1 ± 22.0	27.8	4	140.4 ± 23.8	16.9	11	94.3 ± 14.6	15.5
13	Jessore	1371	3376	12	697.3 ± 34.6	5.0	563.7 ± 45.7	8.1	5	564.7 ± 32.7	5.3	17	611.1 ± 21.9	3.6
14	Khulna	1592	2022	9	124.3 ± 60.5	48.7	154.7 ± 83.7	54.1	5	84.9 ± 20.9	24.4	14	120.0 ± 34.2	28.0
15	Maldah	1275	1327	7	332.8 ± 124.0	33.0	274.0 ± 87.8	32.0	3	254.2 ± 81.3	23.3	10	254.2 ± 56.2	22.1
16	Midnapore	3393	3268	14	90.0 ± 32.6	36.3	141.2 ± 31.7	22.4	7	50.2 ± 17.3	34.5	21	193.8 ± 13.0	19.2
17	Nuskillabad	1307	1529	7	339.8 ± 80.1	23.6	323.1 ± 103.6	20.6	4	436.0 ± 143.3	32.9	11	273.9 ± 33.8	12.3
18	Mymensingh	3963	7093	21	724.2 ± 97.5	13.7	944.0 ± 97.5	10.5	9	632.9 ± 150.6	23.8	30	772.8 ± 18.6	2.9
19	Nadia	1811	1929	9	660.1 ± 34.2	5.2	584.8 ± 53.4	9.1	5	514.7 ± 165.5	26.7	14	583.9 ± 41.3	7.1
20	Noakhali	244	724	2	325.8 ± 68.5	21.2	325.6 ± 27.2	8.1	3	418.4 ± 5.4	1.3	5	333.3 ± 32.2	7.9
21	Pabna	1164	4472	7	177.0 ± 49.7	28.0	192.2 ± 55.9	29.1	4	262.7 ± 22.3	15.9	11	213.0 ± 22.1	13.2
22	Rajshahi	1611	1476	7	121.4 ± 29.8	34.6	133.1 ± 22.2	16.8	3	347.0 ± 132.3	38.1	10	186.0 ± 39.9	25.4
23	Rangpur	2302	4773	12	543.3 ± 100.6	18.5	429.7 ± 52.6	12.7	7	401.6 ± 86.8	21.6	19	455.2 ± 67.1	14.7
24	Tipperah	1058	2617	7	212.3 ± 75.6	35.6	257.0 ± 83.0	32.3	5	521.3 ± 60.8	11.7	12	354.0 ± 42.0	11.9
25	24 Perganas	2276	2663	10	158.0 ± 57.6	36.5	149.3 ± 43.7	29.3	8	79.7 ± 16.6	20.8	18	120.8 ± 25.3	21.0
	Total	43540	59352	214	6867.0 ± 327.0	4.8	6733.2 ± 295.7	4.2	115	6355.1 ± 420.0	6.1	329	6871.2 ± 226.0	3.3

sub-blocks in col.(8.1); and finally the weighted mean estimate based on all three samples in col. (10.1). The respective percentage errors (or variabilities) of the acreage are shown, as before, in cols(5.2), (6.2), (8.2), and (10.2).

43. From col. (10.1) we notice that in the heavier districts with more than four lakhs of acre under Aus paddy, the percentage error of the estimated acreage varied from 7 to 15 per cent. The provincial estimate of 68.71 ± 2.06 lakhs of acre had a percentage error of about 3 per cent which is slightly higher than the percentage error for Jute. In view of the fact that actual acreage under Aus paddy was two and a half times bigger, it is clear that the margin of error of the Aus estimate was comparatively much wider.

45. The sample estimate of the area under Aus paddy, namely, 68.71 ± 2.06 lakhs of acre, is appreciably less than the official estimate of 79.15 lakhs of acre. The excess of more than 10 lakhs of acre is more than 14 percent of the sample estimate; and is clearly outside the limiting margin of error of say six per cent at 20 to 1 odds, and cannot possibly be explained by sampling fluctuations.

44. The difference I believe may to a large extent be due to confusion between Aus and Aman paddy in the sample survey. It would be remembered that this was the first year of an organized survey of Aus paddy in Bengal. We had no previous experience, and the field staff also had no experience of distinguishing between Aus and Aman paddy. In fact in many regions in Bengal this distinction is often ambiguous. Varieties which are called late Aus by some people are sometimes called early Aman by others. The method of sowing (transplanting or broadcasting) is no sure criterion. Harvesting of rice also goes on practically continuously almost through out the year in some part or other of the province.

45. In this situation the chance of confusion between Aus and Aman is great. Many types of mistakes can easily occur. For example, where the area survey is done say in July it is possible for a plot to be taken as being under Aman when it is really under Aus. On the other hand, it is also possible for plots sown with Aman quite early in the season being taken as Aus. Until the harvesting of Aus is completed, both Aus and Aman paddy would be often growing side by side. By October or November most of the Aus would be harvested, and the chance of Aman

of Aman being shown as Aus at this time would be small. On the whole, the there is a greater possibility of Aus being shown as Aman than the other round. The fact that the sample estimate for Aus paddy is falling short official estimate is in broad agreement with this. I, therefore, consi not only possible but quite probable that the sample estimate of the acre unde Aus is really smaller than the true value because of an appreciable of plots under Aus Paddy having been transferred by mistake to Aman.

46. The only possible method of preventing such mistakes would be to the Investigators to note the height and condition of the crop in each pl A comparison of such detailed records collected during the Aus and Aman respectively would then enable the two crops being distinguished without ambiguity. Unfortunately, owing to the earlier decision to abandon the survey, we naturally did not think it worth while to make arrangements f keeping such detailed records. We, however, intend doing this in future

YIELD OF BORO PADDY, JUTE, AND AUS PADDY : 1945.

47. We may now turn to the yield of Jute and Aus paddy in Bengal in 1945. Before doing this I shall briefly consider certain results relating to Boro (or summer paddy which is usually harvested before the rains set in) on which some crop cutting work was done before starting the area survey.

Rate of Yield of Boro Paddy: 1945.

48. The mean yield of rice (not in husk) in maunds per acre of Boro paddy based on this crop cutting work is shown in Table (6 in which col.(1) gives the name of the district, col.(2) the name of the locality; col.(3) the mean yield in maunds per acre.

Bengal Crop Survey 1943-44 : Boro Rice 1945

Table '6). Mean Yield of Rice (not in husk) in mds. per acre.

Name of District	Name of Police Station	No. of cuts	Mean Yield per acre
(1)	(2)	(3)	(4)
Dacca	Kaliganj	102	13.47
"	Manohardi	15	8.64
"	Kapasia	30	11.06
"	Shibpur	20	10.58
"	Rupganj	18	9.92
"	Jaydevpur	18	9.72
Total		205	11.93
Pabna	Chatmohar	20	12.91
"	Faridpur	32	14.91
"	Atgharia	26	15.92
"	Bera	14	14.49
Total		92	15.54
Tippera	Brahmanbaria	24	19.72
"	Sarail	16	19.35
"	Nasirnagar	20	16.66
"	Nabinagar	34	11.99
Total		94	16.73
Mymensingh	Isvarganj	72	9.96
"	Netrokona	72	9.75
"	Baghatta	72	14.44
"	Purbadhala	72	13.85
"	Mohongunj	72	7.54
Total		360	11.10
Districts Combined		746	12.58

49. It would appear from the figures given in this table that there were large variations from district to district, and also, but to a considerable smaller extent, from locality to locality within the same district. Apparently the yield was highest in 1445 in Tippera with a value of 16.75 maunds per acre; moderate in Pabna with 15.54 maunds per acre; and much lower in Dacca with 11.05 and in Mymensingh with 11.10 maunds per acre.

50. The average for all the 4 districts taken together was 12.35 maunds per acre. I should observe however that this average has no definite meaning as the samples were not collected in a properly representative manner; it is therefore simply a kind of arithmetic average the exact meaning of which is not clear.

Crop-cutting work on Jute and Aus Paddy

51. In previous years crop cutting was done after practically completing the bulk of the area survey work. This however was unsatisfactory for harvesting of jute usually started before it was possible to complete the area census. This year we made an attempt for the first time to begin crop cutting work as soon as harvesting started in the different sub-blocks. It was arranged that one of the Investigators having previous crop cutting experience should be released for this work, and the area survey work would be distributed among the remaining investigators. The Inspectors were permitted to extend the programme for the area survey work in such cases to the extent necessary for completing the compulsory grids.

52. Actual crop-cutting work began in the first week of July and continued up to the end of September. In the General or Extensive Scheme I 54 Investigators worked on Jute at 52 centres in 15 districts and on Aus at 65 centres in 14 districts. Relevant data are given for Jute in Table (7), and for Aus in Table (8). A pair of sample cuts located at random (called a "double") was harvested from each plot. The size of each sample-cut was 8' x 8' (=64 square feet) for Jute, and 4'. x 4' (= 16 square feet) for Aus. The total number of sample-cuts secured was 1078 for Jute and 2312 for Aus paddy.

Table (7). Mean Yield of Jute in maunds of dry fibre per acre.
(Extensive Scheme I)

Name of District.	Number of Centres	Doublets.	Yield of dry fibre of Jute in mds. per acre. 1st cut (No.1) Mean ± S.E.	2nd cut(No.2.) Mean ± S.E.	Combined. Mean ± S.E.	Difference ($m_1 - m_2$) t.	P.
(1)	(2)	(3)	(4.1)	(4.2)	(5)	(6)	(7)
1. Backergunj	2	3	16.45 ± 7.05	15.99 ± 8.00	16.17 ± 5.33	+0.06	0.97
2. Bogra	5	74	15.25 ± 0.81	15.73 ± 0.74	15.43 ± 0.55	-0.44	0.66
3. Dinajpur	7	149	12.55 ± 0.26	10.75 ± 0.46	11.97 ± 0.26	+0.39	0.00
4. Faridpur	5	26	12.42 ± 1.17	12.09 ± 0.64	12.4[illegible] ± [illegible]	+1.77	0.00
5. Hooghly	1	18	13.99 ± 0.73	14.14 ± 0.64	13.99 ± 0.49	-0.14	0.83
6. Jessore	2	98	27.43 ± 0.72	26.77 ± 0.86	27.10 ± 0.56	+0.83	0.5[illegible]
7. Kalidah	2	26	12.05 ± 0.64	11.95 ± 0.11	12.00 ± 0.32	+0.15	0.88
8. Kymenshingh	14	285	14.80 ± 0.49	16.72 ± 0.61	15.76 ± 0.47	+1.96	0.05
9. Malda	1	22	8.31 ± 0.93	7.89 ± 1.09	8.10 ± 0.72	+0.23	0.77
10. Noakhali	2	2	4.32 ± 1.78	4.83 ± 0.76	4.58 ± 0.97	-0.26	0.79
11. Pabna	1	12	19.26 ± 1.87	19.52 ± 1.76	19.39 ± 1.28	-0.10	0.92
12. Rajshahi	1	14	18.64 ± 1.54	16.15 ± 1.62	18.36 ± 1.12	+0.22	0.82
13. Rangpur	8	103	9.14 ± 0.36	9.01 ± 0.50	9.08 ± 0.31	+0.21	0.83
14. Tipperah	2	79	19.50 ± 0.84	19.67 ± 0.45	19.58 ± 0.35	-0.24	0.81
15. 24 Parganas	1	7	13.95 ± 0.71	14.55 ± 1.52	14.25 ± 0.84	-0.30	0.76
15 Districts	82	916	15.10 ± 0.54	15.55 ± 0.59	14.22 ± 0.39	-0.57	0.5[illegible]

Rate of Yield of Jute : 1943.

53. The mean yield in acre of Jute by districts is given in Table (7). In most cases the plants were weighed before retting. These weights were then converted into equivalent quantities of dry fibre at the rate of 0.0598 maunds of dry fibre per maund of green plant. In Table (7) col. (1) gives the name of the district; col.(2) the number of centres or localities; and col.(3) the number of plots in each of which a doublet (or two sample-cuts of 8' x 8') were harvested. The yield in maunds of dry fibre per acre based on the first sample-cut is shown in col.(4.1), ar the corresponding yield based on the second sample-cut in the same plot in col.(4.2). The mean value based on both sample-cuts is shown in col.(5) Standard errors of the mean values calculated from grouped frequency table are also shown in each case. Finally, for comparison of observed values with expected values calculated from statistical laboratory, certain techn nical constants called "d" (= difference between the two estimates given in cols.(4.1) and (4.2)divided by the standard error of this difference) are given in col.(6); and the probability of occurence of the observed difference in col. (7).

54. It will be noticed that there were considerable fluctuations in the mean yield from district to district. The yield appeared to have been highest Jessore (27.10 maunds per acre), in Tipperah (19.6) and Rajsahi (18.4). On the other hand, the yield was very low in Noakhali but as this was based on only two plots, no weight can be attached to this result. The yield was also low in Nadia (8.1), Dinajpur (11.0) and Rangpur (12.3). The district figures are however not all equally reliable. In many cases the estimates are based on a very small number of cuts. In order to obtain reliable estimates for the different districts it is necessary to collect a sufficient number of cuts from each district. In 1943 it was not possible to arrange this for reasons explained in an earlier section. It is not possible, therefore, on the basis of the present material, to attach any importance to the district estimates given in the present table. The 15-district estimate of 14.22 maunds per acre also can not be considered to be representative.

Rate of Yield of Aus Paddy : 1943.

55. The yield of Aus Paddy in maunds per acre is shown by districts in Table(8) in which the arrangement of the different columns is exactly the same as in Table (7). The estimates are based on a pair of sample-cuts (or a "doublet") located at random on each plot, the size of each cut being 4' x 4' (= 16sq. feet). In most cases the crop was weighed immediately after harvesting and the figures were later converted into dry paddy by multiplication by the standard factor 0.87 and then subsequent conversion into rice (not in husk) by multiplying the weight of dry paddy by the standard conversion factor 2/3,. The figures in this table are therefore all expressed in maunds of rice (not in husk) per acre.

56. As in the case of Jute, and for exactly the same reasons already explained in an earlier section, it was not possible to collect sufficient number of sample-cuts from each district. Much importance can not be therefore attached to the district estimates, besides noting that the yield apparently fluctuated a good deal from district to district.

Table (9). Mean Yield of Aus Rice (not in husk) in maunds per acre.

(Extensive Scheme I)

Name of Districts.	Number of Centres. Double-ints.	Yield of Rice (not in husk) in mds.p.acre. 1st cut (m 1). Mean ± S.E.	2nd cut (m 2). Mean ± S.E.	combined. Mean ± S.E.	Difference. m 1 - m 2. S.E.	
(1)	(2)	(3)	(4.1)	(4.2)	(5)	(6) (7)
1 Backerganj	9	126	19.56 ± 1.34	19.65 ± 1.07	19.60 ± 0.86	-0.05 0.96
2 Bogra	6	87	10.05 ± 0.45	9.40 ± 0.52	9.78 ± 0.34	+ 0.37 0.34
3 Dinajpur	8	132	19.99 ± 0.54	21.05 ± 0.54	20.52 ± 0.38	- 1.40 0.16
4 Faridpur	2	17	11.93 ± 1.37	11.23 ± 1.37	11.58 ± 0.97	+ 0.36 0.72
5 Hooghly	1	26	15.81 ± 0.88	16.81 ± 0.72	16.21 ± 0.57	- 0.70 0.49
6 Howrah	1	13	7.80 ± 0.42	7.66 ± 0.34	7.79 ± 0.27	+ 0.41 0.68
7 Jalpaiguri	4	59	6.65 ± 0.45	6.21 ± 0.34	6.45 ± 0.27	+ 0.81 0.42
8 Murshidabad	7	103	9.88 ± 0.41	9.88 ± 0.41	9.85 ± 0.29	- 0.17 0.67
9 Mymensingh	12	258	10.82 ± 0.22	10.67 ± 0.20	10.75 ± 0.15	+ 0.56 0.62
10. Nadia	2	62	11.70 ± 0.50	12.13 ± 0.52	11.92 ± 0.36	- 0.60 0.54
11. Pabna	2	16	11.32 ± 0.34	11.13 ± 0.40	11.23 ± 0.26	+ 0.37 0.72
12. Rangpur	7	104	10.95 ± 0.38	11.04 ± 0.37	10.99 ± 0.26	- 0.17 0.86
13 Tipperah	2	33	6.79 ± 0.60	6.96 ± 0.33	6.88 ± 0.34	- 0.30 0.84
14 24 Parganas	2	72	15.65 ± 0.41	15.67 ± 0.46	15.66 ± 0.31	- 0.05 0.98
14 Districts.	65	1157	12.34 ± 0.17	12.42 ± 0.16	12.38 ± 0.12	- 0.33 0.74

58. The 14-district pooled yield was 12.38 maunds per acre . But this cannot be considered to be a representative value of the average yield for the province as a whole as the sample-cuts were not distributed among different districts in a random manner. The pooled value is thus simply an arithmatic result without any clear physical meaning.

59. As already noted the number of sample-cuts obtained was very small in some of the districts. This was due to the fact that either the crop was not ready for being harvested or the crop had been already harvested in the village in which some of the field units were working on the area survey at that time. This, in fact, is one of the outstanding difficulties in arranging crop cutting work. The crop becomes ready at different times even within the same Block. Information is difficult to obtain so that either men have to be kept waiting for the crop to become ready for being harvested, or men have to be moved from other centres as soon as information is received that harvesting was about to start. In either case a good deal of time and money would be wasted.

59. To get the crop cutting work done by the area survey investigators would thus always present considerable organizational difficulties. On the other hand, to appoint an entirely separate staff for crop cutting work would also be inconvenient and unnecessarily expensive. The only sound policy would appear to be to get as much crop cutting work done as possible

possible by the area survey investigators in the regions in which they happen to be working at the time the crop is being harvested and at the same time also to have an auxiliary band of crop cutting workers ready for being sent at suitable times to places where harvesting is going on but where no area survey workers happen to be available. Something in this direction was tentatively attempted during the Aman survey with a good deal of success; this would be discussed in the report on the Aman Survey.

60. Special Studies : Besides the extensive or general scheme of crop cutting work described above, arrangements were also made for a number of special experiments for collecting basic information relating to the design for crop estimating surveys. Although the methods used and the results obtained are of a technical nature, a brief description of these Schemes is given below for convenience of reference.

Variance Function

61. Three special schemes were used to study the Variance Function.

Scheme III(A) : A compact group of villages was selected and sample cuts were obtained in all plots on which jute or Aus happened to be available at the time of the experiment. Work was done on Jute in two centres, Gaibandha and Keshabpore, and on Aus in Keshabpur and Sonbarspore. The standard size of the sample cut for Jute was 8' x 8' and for Aus 4' x 4' ; and total number of cuts actually secured was 1070 for Jute and 930 for Aus.

Bengal Crop Survey 1943-44; Jute Crop-Cutting Scheme III(A).

ble (9). Analysis of Variance : Yield of Jute in maunds of dry fibre per acre from all available plots in a compact groupof villages.
(Mean Yield = 15.99 maunds of dry fibre of jute per acre.)

ure of Variation.	D.F.	Sum of Squares.	Mean Square.	Ratio.
(1)	(2)	(3)	(4)	(5)
een-Police Station	1	3808.68	3808.68	68.7
een Mouza Within P.S.	6	3439.28	573.21	10.8
erm Mouza	7	6647.96	949.71	15.0
ween plots within Mouza	532	29289.18	54.99	1.0
ween plots	539	35937.14	66.67	1.5
thin plots	540	28832.00	52.84	1.0
al	1079	64469.15	57.50	—

62. The analysis of variance for difference in mean yield of Jute between centres; between mauzas within centres; between plots within mauzas; and finally between sample-cuts within plots is shown in Table (9). The observed variance appear to be much the same within plots and between plots within mauzas. The variation between mauzas was about 10.18 times greater, while the variation between centres was much higher and about 60.7 times the variance within plots.

63. The corresponding analysis of variance for Aus is shown in Table (10). Here the variance between plots within mauzas was higher and 85.5 times greater than the variance within plots. The variance between mauzas within centres was also correspondingly higher and the ratio of variances was 1057. The variance between mauzas was thus somewhat more than ten times greater than the variance between plots within mauzas as in the case of Jute. The variance between the centres was, however, comparatively small in the case of Aus, the ratio of variances being only 124.

Bengal Crop Survey 1944-45: Aus 1945 Crop Cutting Scheme III(A).

Table (10). Analysis of variance of Yield of Rice (Not in husk) in mds.per acre. (Mean Yield = 9.39 maunds per acre.)

Source Variation.	D.F.	Sum of Squares.	Mean Square.	Ratio.
(1)	(2)	(3)	(4)	(5)
Between Centre	1	42.96	42.96	124.0
Between Mouza within Centre	6	2197.98	366.33	1057.2
Between Mouza	7	2240.94	320.13	923.9
Between plots within Mouza	472	13985.45	29.63	85.5
Between plots	479	16226.39	33.87	97.8
Within plots	480	167.40	0.35	1.0
Total	959	16391.79	17.09	—

64. Scheme III(B) : One plot of Jute was selected at each of the centres (Mymensingh and Kaliakhali), and the whole plot was harvested in the form of 1240 cuts of size 4' x 4'. The variance function based on these cuts is shown in Table (11). The agreement between observed and graduated values is quite satisfactory.

Bengal Crop Survey 1943-44 : Jute Crop Cutting Scheme III(B).

Table (11). Variance Function based on 4' x 4' sample-cuts in one plot in mds. of dry fibre of Jute per acre.
(Mean Yield = 20.99 mds per acre.)

Size of cut.	Mean.	Variance.		C.V.	
		Observed	Graduated.	Observed	Graduated.
(1)	(2)	(3.1)	(3.2)	(4.1)	(4.2)
16	20.58	29.90	30.15	26.50	26.67
64	21.00	20.61	20.61	21.61	21.81
144	21.39	17.18	16.50	19.37	18.99
256	21.10	14.39	14.09	18.10	17.79
400	20.89	11.88	12.47	16.48	16.62

Variance $= a(x)^{-g} = 64.82\ 25(x)^{-0.27\ 44}$

where(x) = size of cut in sq: feet.

65. It would be noticed that values of the 'g' constant is about 0.27 approximately. This shows the existence of high correlation in adjoining plots, and indicates that increasing the size of the sample-cuts is not likely to be of much use in reducing the margin of error. In other words, the present evidence points to the use of sample-cuts of comparatively small size. The best or optimum size can of course be only decided in reference to cost of operations and need not be further discussed here.

66. Scheme III(C) : A compact group of villages was selected in one centre (Rajanahi) and 8' x 8' sample-cuts of jute were obtained from 10 to 15 plots selected at random in each village. Information was obtained in this way for 279plots scattered over 28 villages in 3 police-stations. The analysis of variance is given in Table (12). The variance of plots within mauzas is much greater in this case as compared to that observed in the scheme III(A) shown in Table (9).

Bengal Crop Survey 19 -44: Jute Crop-cutting Scheme III(C).

Table (12): Analysis of variance of Yield in mds. of dry fibre per acre, from cuts of 8'x 8' from plots selected at random in villages.
(Mean Yield = 12.31 mds. of dry fibre per acre.)

Source of variation.	D.F.	Sum of squares.	Mean Square.	Ratio.
(1)	(2)	(3)	(4)	(5)
Between Police Station	2	1009.85	504.92	469.6
Between Mouza within P.S.	25	4481.93	179.24	166.7
Between Mouza	27	5499.86	203.37	189.1
Between plots within Mouza	252	16135.37	64.04	59.5
Between plots	279	21635.42	77.51	72.1
Within plots	290	311.82	1.08	1.0
Total	569	21947.61	38.54	—

67. Without entering into technicalities I may explain briefly that the object of the present series of studies was to obtain information about the nature and magnitude of the fluctuations in yield per acre from spot to spot. For example, we are trying to get an idea whether fluctuations are stronger between different sample-cuts within the same plot, or between different plots in the same village, or between the mean yield of villages themselves and also how far and in what way the mean yield of groups of villages or of subdivisions change from region to region. The picture is becoming more clear. For example, we find that fluctuations in the mean yield are greater from plot to plot within a single village as compared to fluctuations between different sample-cut within the same plot. If this result is fully confirmed then obviously it would not be necessary to take more than say two sample-cuts in the same plot, but it would be desirable to take a number of plots within a selected village.

68. With the collection of some further material we hope to be able to formulate the sample design or pattern on an objective basis. I must mention however that there are still many gaps to be filled up. The picture is often conflicting. This may be due to intrinsic irregularities in fertility. On the other hand, the conflicting evidence may also be at least partly due to the unreliability of the field work. In fact in crop-cutting work such unreliability has so far been the greatest single obstacle to progress. If we were certain that the data collected by the field staff were genuine then we would have been able by this time to devise a suitable technique. We find, however, that there are irregular fluctuations not only from year to year but from region to region in the same year which if true would show a singular lack of uniformity in natural variation. In sharp contrast to the conflicting nature of the evidence in the case of material collected by the general body of observers we find that data collected at special centres of by examiners at the time of the eye-estimation tests (described later) are on the whole fairly regular and fit in to other quite satisfactory. This contranst naturally makes one believe that much of the irregularity observed in the results collected in the general or extensive scheme must be ascribed to the unreliability of the primary material rather than to intrinsic irregularities in natural variations of yield.

69. The moral is quite clear. We must improve the quality of the primary material. The only way in which this can be ensured is by adopting without delay a policy of recruiting a more or less permanent staff of field workers.

The Cost Function

70. I may now briefly describe some of the results of the special studies of the Cost Function. The time taken for the enumeration of grids in the area survey for different densities of sheets and different coverages is shown in Table (13) in which col. (1) gives the different ranges of densities of sheets (the separate pieces of C.S. village maps each containing a group of 5 grids), namely, 0.09 to 0.14; 0.25 to 0.50; 0.41 to 0.56; 0.57 to 0.72 sheet per square mile. Under each range of density is given the number of sub-blocks and the mean number of enumeration -days spent per sheet (each containing (group 5 grids) exclusive of the time required for moving from one camp to another.

Table (13) Area Survey : Number of enumeration days spent per sheet (Group of 5 grids) excluding camp changes.

Coverage per party in square miles	Density per Square mile									
	.09-.24		.25-.40		.41-.56		.57-.72		Overall	
	N	mean	N	mean	N	mean	N	mean	N	mean
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(0)	(11)
- 50	3	1.58	5	1.75	-	-	6	0.80	14	1.38
. 75	5	1.19	16	1.11	14	0.66	63	0.52	98	0.87
- 100	19	0.95	178	0.91	60	0.66	41	0.59	299	0.78
. 125	15	0.81	76	0.85	16	0.62	9	0.57	116	0.71
Mean	40	0.96	275	0.92	90	0.65	119	0.56	524	0.94

71. For the two smaller densities of 0.09 - 0.24 and 0.25 - 0.50 we find that enumeration time per sheet decreases with increasing coverages but for the two higher densities the changes is inappreciable. Looking at the bottom line we also find that the enumeration time per sheet steadily decreases with increasing density per sheet which of course is just what one would expect as the time for journeys would become progressively less important with increasing densities.

72. Scheme (IV): Sample-cuts of Jute with a constant density of two cuts per square mile was used with four different coverages, namely, 25, 50 and 75 and 100 square miles. The work was arranged in a sectorial form, that is, the whole circle was divided into a number of sectors and the workers were asked

to complete the work in each sector before taking up the work in another.

The experiment was arranged in the form of a balanced design of 4 workers x 4 weeks; and 447 and 268 cuts were collected from two centres Kishoreganj and Gouripore.

Table (14). Jute Crop Cutting Scheme IV Number of pay days per sample cut of (8 x 8) by Coverage and Workers (W)

Coverage	W1		W2		W3		W4		All workers	
	No. of cuts	Days per cent	No. of cuts	Days per cent	No. of cuts	Days per cent	No. of cuts	Days per cent	No. of cuts	Days per cent
(1)	(2.1)	(2.2)	(3.1)	(3.2)	(4.1)	(4.2)	(5.1)	(5.2)	(6.1)	(6.2)
				Centre - Kishoreganj						
25 Square miles	55	.13	52	.12	62	.08			169	.11
50 " "	38	.18	48	.12	11	.64			97	.21
75 " "	68	.11	34	.20	68	.10			168	.12
100 " "	32	.22	30	.25	36	.19			93	.21
				Centre - Gouripur						
25 Square miles	68	.09	58	.12	66	.12	72	.10	258	.10
50 " "	64	.11	63	.14	60	.12	64	.11	256	.12
75 " "	54	.13	36	.12	54	.13	56	.12	220	.13
100 " "	48	.14	40	.18	44	.16	48	.14	180	.16

73. Table (14) shows the number of pay-days per sample-cut of 8' x 8' of jute by coverages and workers. In Table (14) col. (1) gives the different sizes of coverages or the area over which the crop-cutting work was done from each camp (i.e. place in which the workers spent the night). Data for individual workers are then given in successive columns; in col. (2.1) for example, is shown the total number of cuts obtained by worker No. W(1) and in col. (2.2) the number of days per cut required for completing the work. In the same way the total number of cuts and the number of days per cut are shown for the other workers in the succeeding columns. Finally, the results obtained by pooling together the observations for all workers are shown in the last two columns; the total number of cuts is given in col. (6.1) and the average number of days per cut in col. (6.2).

74. The material secured at the Kishoreganj was rather irregular as fluctuations between workers were large. Pooling the records for all three workers does not make much difference and the effect of increasing the coverages if any, is not appreciable. The material collected at Gouripore was more satisfactory. In the case of practically every worker the time per sample-cut increases with increasing size of coverage. This

This is also brought out clearly in the pooled results for all workers given in the last column. We find in fact that the time per cut increases from 0.10 for coverages of size 25 square miles to 0.16 for coverages.

75. Scheme (V) : In this scheme the coverage was kept constant at 50 square miles, and the overall density of two plots per square mile was also kept constant. The local densities used were however different; 2 plots per village, 4 plots per alternate village, 6 plots in every third village, and 8 plots in every fourth village. A balanced design of 4 workers x 4 weeks was used, and information was collected for 273 and 324 plots of jute in two centres.

Table (15) Crop cutting Scheme V : Number of pay days per sample cut (8'x8') of jute by density patterns and workers

Density Patterns	W1		W2		W3		W4		All workers	
	No. of cuts	Days per cent	No. of cuts	Days per cent	No. of cuts	Days per cent	No. of cuts	Days per cent	No. of cuts	Days per cent
(1)	(2.1)	(2.2)	(3.1)	(3.2)	(4.1)	(4.2)	(5.1)	(5.2)	(6.1)	(6.2)
				Centre - Rangpur						
2 plots per village	44	0.20	36	0.22	44	0.20	48	0.17	172	0.20
4 plots per alternate village	60	0.13	48	0.13	48	0.17	26	0.38	182	0.19
6 plots in every 3rd village	56	0.14	48	0.21	40	0.22	64	0.14	188	0.17
8 plots in every 4th village	64	0.14	32	0.28	52	0.15	48	0.17	196	0.17
				Centre - Mymensingh						
2 plots per village	56	0.12	28	0.39	44	0.20	48	0.17	176	0.20
4 plots in alternate village	28	0.25	28	0.25	0	0.22	64	0.14	100	0.20
6 plots in every 3rd village	48	0.14	36	0.08	48	0.17	26	0.38	158	0.18
8 plots in every 4th village	28	0.25	28	0.25	52	0.15	48	0.17	156	0.18

8' x 8' of jute by density patterns and workers. Col. (1) gives the density pattern such as two plots per village, 4 plots in alternat villages etc, col. (2.1) gives the number of cuts harvested by each worker, and col. (2.2) the corresponding number of pay-days per cut required by him to do this work. In the same way, the succeeding columns give similar data for the other three workers at each centre. Finally, pooled values for all workers taken together are given in the last two columns; the total number of cuts in col. (6.1) and the number of pay days per cut in col. (6.2).

77. This experiment was done at two centres Rangpur and Naogaon. Variations between different workers were large. Looking at Col.(6.2) however we find that with increasing number of plots per village there was a slight decrease in the time or cost per cut. This is what one would expect. In fact the surprising thing is that the decrease in time with increasing density of plots in each village was not more rapid.

78. Scheme V(B): In this scheme the local density of two plots per village was kept constant; but the overall density was varied from 2 plots per square miles to 2 plots in 2 square miles, 2 plots in 4 squares miles, and 2 plots in 8 square miles. The design was one of 4 workers x 4 weeks; and information was collected for 262 and 252 plots of Aus in two centres.

Table (16). Crop Cutting Scheme V(B) Number of pay days per sample cut (4' x 4') of Aus by density patterns and workers.

Density patterns	W 1		W 2		W 3		W4		All workers	
	No of cuts	Days per cut	No of cuts.	Days per cut.	No. of cuts	Days per cut.	No. of cut.	Days per cut.	No. of cuts.	Days per cut.
(1)	(2.1)	(2.2)	(3.1)	(3.2)	(4.1)	(4.2)	(5.1)	(5.2)	(6.1)	(6.2)
Centre- Jessore.										
2 per square mile	48	0.15	34	0.21	36	0.19	28	0.28	146	0.20
2 in every 2 square mile	48	0.14	34	0.21	44	0.18	24	0.21	150	0.18
2 " " 3 " "	32	0.22	30	0.27	40	0.18	28	0.25	130	0.22
2 " " 4 " "	30	0.27	-	-	40	0.18	28	0.25	98	0.22
Centre - Chuadanga.										
2 per square mile	-	-	24	0.33	36	0.13	30	0.25	120	0.24
2 in every 2 square mile	40	0.12	24	0.21	32	0.22	32	0.12	128	0.19
2 " " 3 " "	28	0.25	36	0.19	28	0.14	-	-	92	0.20
2 " " 4 " "	32	0.22	36	0.19	28	0.25	28	0.18	124	0.21

79. Observational results are given in Table (16) in which the arrangement of the columns is similar to that in Table (15). The density patterns are shown in col.~~(1)~~(1), the total number of cuts harvested ~~of~~ by the first worker is shown in co. (2.1) and the corresponding number of days per cut required for completing the work in col.(2.2). Similar data for other workers are shown in succeeding columns, and for all workers taken together in the last two columns. The evidence is extremely conflicting. For example, in col.(2.2) the time per cut

time per cut increases with decreasing density; in other cases, for example, in col.(2.2) at Chuadanga, apparently there is an appreciable decrease with increasing density. The pooled values shown in col.(6.2) are also rather irregular.

80. Scheme (VI). The increase in enumeration time for increasing sizes of cuts is shown in Table (17) in which col.(1) gives the serial number of the workers; col.(2.1) the number of cuts of size 4' x 4' and col.(2.2) the time in minutes required for completing the enumeration of each cut. In the same way, the number of cuts and the mean time required for the enumeration of sample-cuts of sizes 8' x 8', 12' x 12' 16' x 16', and 24' x 24' are shown in succeeding columns. The experiment was arranged in the form of a Graeco-Latin square.

Table (17): Jute Crop cutting Scheme VI: enumeration time in minutes by workers and size of cut

Serial No. of workers	Size 4'x 4'		Size 8' x 8'		Size 12'x 12'		Size 16'x 16'		Size 24'x 24'	
	n	Mean	n	Mean	n	Mean	n	Mean	n	Mean
(1)	(2.1)	(2.2)	(3.1)	(3.2)	(4.1)	(4.2)	(5.1)	(5.2)	(6.1)	(6.2)
				Camp - Mymensingh.						
1	32	18.90	24	25.10	16	57.40	16	57.35	12	110.80
2	32	13.75	24	22.50	16	52.00	16	52.80	8	130.40
3.	32	12.35	24	32.85	16	45.00	16	61.30	8	145.00
4.	40	13.50	24	27.50	16	51.05	16	56.70	8	136.25
5	32	20.45	28	32.70	16	37.20	16	73.60	8	92 .50
Centre. Average.	168	16.19	124	28.15	80	50.11	80	61.45	44	122.39
				Camp - Rajbari						
1	50	11.60	24	38.80	20	46.00	16	61.90	8	133.10
2	48	23.30	20	40.50	20	52.20	16	57.20	8	146.20
3	34	11.00	26	36.50	22	58.70	16	78.50	8	118.80
4	62	7.90	28	19.00	24	48.50	16	62.40	8	100.10
5	56	17.20	28	46.40	24	53.00	14	54.70	8	115.00
Centre. Average	270	14.38	126	36.00	110	44.80	78	62.80	40	123.40
Average of both Centres	438	15.28	250	32.51	190	47.45	158	62.17	84	122.89

81. Work was done at two centres, Mymensingh and Rajbari. A glance at the bottom line in each portion (in which are given pooled values for all workers) would show that the results at the two centres are in very good agreement. We find that the meantime of enumeration rises from 15 or 16 minutes for cuts of size 4' x 4' to about half an hour for cuts of size 8' x 8', and to about 50 minutes for cuts of size 12' x 12',

The average time required is a little over an hour for cuts of sizes 16' x 16'; and a little over two hours for cuts of size 24' x 24'. There is thus a steady rise on the time required for enumeration as the size of the sample cut is increased which is just what should happen.

83. Pooled Rates of Yield of Jute and Aus: I have already discussed the results of the general or extensive scheme of crop cutting experiments on Jute and Aus in connexion with Tables (7) and (8). We have, however, a good deal of additional data relating to yields in the special experiments described above. If we incorporate the whole material we get naturally somewhat better estimates.

Table (18) : Pooled Mean Values of Yield per Acre of Jute and Aus Paddy : 1944.

Name of District.	Jute			Aus Paddy		
	No. of Centres.	No. of Sample -cuts.	Yield of dry fibre in mds. per acre.	No. of Centres.	No. of sample -cuts.	Yield of husk r ice not in husk in mds. per acre.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1. Bakarganj	2	6	16.17	9	360	16.80
2. Bogra	6	250	13.70	6	174	9.73
3. Chittagong	-	-	-	4	68	12.60
4. Dacca	5	72	14.60	1	8	10.90
5. Dinajpur	7	238	10.97	8	224	20.52
6. Faridpur	3	52	12.45	2	54	11.58
7. Hooghly	1	16	13.39	1	52	18.81
8. Howrah	-	-	-	1	16	7.20
9. Jalpaiguri	5	70	10.30	4	118	6.45
10. Jessore	5	446	16.80	11	1498	13.60
11. Malda	2	52	12.00	-	-	-
12. Murshidabad	-	-	-	7	296	9.82
13. Mymensingh	17	2404	16.20	12	516	10.75
14. Nadia	1	44	8.10	5	202	7.70
15. Noakhali	2	4	4.08	5	116	9.40
16. Pabna	2	10	17.70	2	32	11.20
17. Rajshahi	8	344	17.20	1	8	12.00
18. Rangpur	9	2340	12.30	7	248	10.00
19. Tipperah	2	158	10.58	4	746	7.60
20. 24 Parganas	5	48	16.80	5	224	14.30
Total	68	7234	14.71	93	5246	11.12

84. These are shown in Table (18) in which col.(1) gives the name of the district; col.(2) the number of centres in which crop cutting work was done on Jute; col.(3) the total number of sample-cuts thus made (collected in the form of a doublets or a pair of sample cuts from each plot) of Jute; and col. (4) the mean yield dry fibre of Jute in maunds per acre. In the same way corresponding figures for Aus paddy are given in cols.(5),(6) and (7) respectively.

84. As a large number of cuts were obtained in the special experiments and these special experiments were done at a small number of centres, the number of cuts is very large in some of the districts. For Jute, for example, we have more than 200 cuts in Mymensingh (3604), Rangpur (2540), Rajshahi (544), Jessore (446), Dinajpur (398), and Bogra (200) If these cuts had been located at random then the mean values would have been quite representative; but unfortunately we know that this was so, and we can not therefore attach much value to the dist ict figures. Similar remarks obviously apply to yields of Aus paddy. However, in spite of such deficiencies in the material, one thing is clear that fluctuations in the yield of both Jute and Aus paddy were large from district to district. This shows that for preparing accurate estimates such variations have to be taken into account.

Total Production of Jute and Aus 194-.

85. I have already explained that crop-cutting work on neither Jute nor Aus in 1943 can be considered satisfactory. The results are neither representative nor entirely reliable. In this situation estimates of the total production of both Jute and Aus paddy must remain to a large extent matters of conjecture. I am however giving in Table (19) t he district figures for what they are worth.

86. In Table (19) col.(1) gives the serial number and name of the district; cols.(2) and (3) the sample and official estimates of the area under Jute in thousand acres; and cols.(4) and (5) the sample and official estimates respectively of the total outturn of Jute in lakhs of maunds of dry fibre. In the same way, cols.(6) and (7) give the sample and official estimates of the area under Aus paddy in thousand acres, and finally cols.(8) and (9) show the sample and official estimates respectively of the outturn of Aus in lakhs of maunds or rice (not in husk).

Table (2a) : Acreage and Total Production of Jute & Aus by Districts : 1 [illegible]-34.

Districts.	Jute				Aus Paddy.			
	Area in thousand acres.		Outturn of dry fibre in lakhs of mds.		Area in thousand acres.		Outturn of rice (not in husk) in lakhs of mds.	
	Sample.	Official.	Sample.	Official.	Sample.	Official.	Sample.	Official.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1. Bauleerganj	47.1	34.5	8.4	5.6	472.1	547	77.0	64.7
2. Bankura					59.5	171	7.4	17.1
3. Birbhum	3.9	0.3	0.4	0.0	4.1	60	0.4	4.7
4. Bogra	83.7	81.4	14.0	9.5	171.7	159	17.3	14.9
5. Burdwan	16.6	7.1	1.7	0.7	60.2	52	6.7	4.7
6. Chittagong	2.0	0.3	0.4	0.0	467.0	289	61.2	30.6
7. Dacca	268.3	185.4	39.2	28.4	388.6	442	41.8	35.8
8. Dinajpur	97.8	97.3	11.1	11.6	824.1	190	55.8	17.7
9. Faridpur	220.7	136.1	30.9	22.6	263.8	510	24.3	50.6
10. Hooghly	21.1	25.0	3.1	3.2	39.1	55	6.1	4.8
11. Howrah	6.7	4.6	1.0	0.6	10.2	14	0.8	1.3
12. Jalpaiguri	61.8	46.8	6.4	4.8	94.8	153	8.3	11.1
13. Jessore	182.1	107.3	30.6	18.9	611.1	467	95.3	49.3
14. Khulna	76.4	29.3	6.3	4.6	120.0	100	14.2	9.5
15. Maldaha	53.6	55.0	7.2	4.4	254.2	311	26.2	25.8
16. Midnapure	7.3	9.5	1.1	1.3	95.8	244	7.7	18.1
17. Murshidabad	58.5	51.3	8.5	6.8	373.9	289	39.6	30.1
18. Mymensingh	719.8	471.9	116.6	71.1	773.8	1282	72.1	120.5
19. Nadia	90.3	73.2	12.9	9.4	533.9	540	45.0	43.2
20. Noakhali	38.3	23.2	5.8	4.4	383.5	311	36.0	24.0
21. Pabna	125.5	103.6	21.9	12.0	213.0	330	23.0	31.0
22. Rajshahi	67.3	98.9	11.6	13.5	181.0	204	25.5	17.5
23. Rangpur	270.2	257.5	35.2	35.0	405.2	753	38.4	73.5
24. Tippera	204.1	167.1	38.2	25.2	254.0	401	27.0	30.9
25. 24 Parganas	72.8	33.9	12.1	3.7	120.8	64	17.3	6.0
Bengal	2754.8	2144.5	420.8	295.3	6876.0	7915	770.1	712.4

87. On account of the wide divergence between sample and official acreage estimates, and also to a smaller extent on account of the difference between sample and official estimates of the rate of yield per acre, there are large differences between the sample and the official estimates of total outturn. For Jute the sample estimate is 420 lakhs of maunds against an official forecast of 295 lakhs of maunds. The [illegible] truth probably lies somewhere between these two limits. The official estimate is in defect by minimum something like 125 of maunds or about 30 per cent of the sample estimate. The position is clearly unsatisfactory. As far as I can judge, the sample estimate of the acreage is fairly reliable, the sample estimates of yield however still lack a sound foundation. A good deal more of careful work is clearly necessary before anything definite can be stated regarding the total outturn of jute.

88. The position is slightly better for Aus as here we have a sample estimate of 770 lakhs of maunds against an official estimate of 712 lakh of maunds. The difference of 68 lakhs of maunds is slightly less than 9 per cent of the sample estimate. We have already seen that the sample of acreage was higher than the official estimate. The discrepancies were thus in opposite directions and had been neutralised to a considerable extent in the production figure. Although the gap is thus much smaller in the case of Aus still the position here also remain unsatisfactory.

General Observations on the Survey

89. I shall now make a few general observations on the survey. I have already stated that conditions in the country were literally unprecedented. It is not surprising, therefore, that the quality of the field work was not satisfactory in every way. We have reasons to believe that field records were sometimes cooked. The material was carefully scrutinized and many different types of internal and statistical checks were used. The subject is necessarily technical; and no useful purpose would be served by going into details. I shall simply give a few examples.

Comparison of Duplicated Grids

90. A detailed comparison ofduplicated grids has thrown interesting light on the nature of discrepancies in the field records. A few concrete illustrations will give a general idea of the kind of results that can be reached by such comparison. Let us consider, for example, how far two different investigators agree in the enumeration of the Jute crop. A typical example is given in Table (20), the total number of plots within the Police Station included in the comparison; col. (5) the number of plots in which Jute was entered by both the workers; col.(4) the number of plots for which the anna-estimate of the proportion of land under Jute as noted by the two workers agreed within ten per cent. The percentage of plots in agreement as having Jute is shown

Table (20) Comparison of Entries relating to Jute in plots enumerated in duplicate by both parties.

Name of Police Station	Total No. of plots	No. of plots in Agreement		Percentage of plots in Agreement	
		Having Jute	Proportion (within 10%)	Having Jute	Proportion (within 10%)
(1)	(2)	(3)	(4)	(5)	(6)
Gopalganj	104	95	94	91 %	90 %
Nagarkanda	145	84	79	58 "	55 "
Sariakandi	939	779	694	83 "	74 "
Kaliganj	475	451	449	95 "	95 "
Raiganj	735	503	408	69 "	56 "
Total	2398	1912	1724	80 %	72 %

as in agreement as having Jute is shown in col.(5); and as having anna-estimates of the

proportion of land under Jute within ten per cent in col. (6). It would be noticed that in Kaligunj the two workers were in agreement to the extent of 95 per cent, while in Nagarkanda the percentage of agreement was much smaller and less than 60 per cent.

Table (21). Comparison of Anna Estimates of Aus in plots enumerated in duplicate Raipur : Aus 1945.

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
0	206	2	9	1	7	4	6	4	41		16	2	10	2	3	1	115	429
1	1		1		1												1	5
2	1		1			x			2						1	1	4	10
3	2				1													3
4	4				1			2	1	1			2				4	15
5							1	1				1	1				1	5
6	3		1		1	1			4	1	1	1				1	3	18
7	2																4	6
8	12				1	1	3	4	2		1		6	2		1	10	43
9	1																	1
10	6								2		1		3				3	17
11																	2	2
12	5				1		2		3		2	2	1		1		6	23
13									1		1	1		1			3	9
14	3	1															2	6
15	1												1		1		3	6
16	24				2	1	4		4		4	2	9		2	2	79	133
Total	271	3	11	1	15	6	16	11	60	2	26	9	33	5	8	6	244	727

Anna-Estimate by Party (A).

91. A still more detailed comparison is possible on the basis of the anna-estimate. I am giving in Table (21) a typical example of the results of a comparison of the entries made independently by Party (A) and party (B) for plots enumerated in duplicated by both the parties. In this Table the anna estimates of the proportion of each plot under Aus crop as entered by party (A) are shown in the different columns; and the corresponding anna-estimates for the same plots as entered by party (B) in the different rows. The headings of the columns and rows therefore run from 0 anna to 16-annas. It will be noticed that 206 is the figure in the cell at the intersection of the column with heading "0" and row "0" this means that 206 (out of the total number of 735 plots covered in the present table) were shown as having no Aus by both the parties. If the entries made by both the parties were in complete agreement then the only entries in the present table would be of the same type, and would occur in the diagonal cells 0 – 0; 1 – 1; 2 – 2; etc. In actual fact

we find a wider scatter. For example, at the intersection of the 7-anna column and 12-anna row we find the entries number 1; this plot was evidently entered as having 7-anna under Aus by Party (A), and as having 12-anna under Aus by Party (B). In the same way in the cell at the intersection of the "16-anna" column and "0" row is 115; these 115 plots were thus returned as having no Aus crop by Party (B) but were entered as having a full 16-anna Aus crop by Party (A).

92. Such discrepancies may have arisen in different ways. First if any plot judged to have a four-anna Aus crop by one worker may quite easily have been considered to have a three-anna or five-anna Aus crop by another worker. Secondly, there may be mistakes in the identification of plots. Thirdly, as the two surveys were made on different dates, some real change might have occurred during the interval. For example, if the first survey was made very early in the season a particular plot may not have had any Aus on it at this time; if the second survey is made much later in the season this plot might have been sown with Aus in the meantime. In such cases although there will be a discrepancy in the entries still both the entries would be correct.

93. Besides discrepancies in area estimates for the same crop it is of course also possible for transfers of entries between different crops. A typical example is shown in Table (22) in which a two-way scatter diagram is given of entries relating to crops for the same plots. The entries made during the first survey between 23rd and 25th June are shown along rows; and the corresponding entries for the same plots made during the second survey between 17th and 21st July among columns. It will be noticed that 116 is the number in the cell at the intersection of the Aus-column and the Aus-row; this shows that 116 out of 473 plots were entered as being under Aus during both the enumerations. In the cell at the intersection of the Aus-row and the Aman-column we find that the number 33; these were shown as being under Aus during the first survey and as being under Aman during the second survey. Here two chances are that the enumeration during the first survey was on the whole correct - Aman is usually not sown in June; the entries made during the second survey in regard to these 33 plots were therefore probably wrong and had arisen from Aus paddy having been taken by mistake as Aman paddy by the second set of investigators. Such transfers between Aus and Aman

of course might easily arise through bona fide confusion between the two kinds of paddy. More serious discrepancies also occur. For example, in the cell at the intersection of the Aman-row and the Jute-column we have the number 6. Evidently these 6 plots were shown as being under Aman paddy at the time of the earlier survey but were shown as being under Jute at the time of the second survey. Such discrepancies might arise through mistakes in the identification of plots.

Table (22) Comparison of entries relating to Crops in plots enumerated in duplicate. P.S. Kaliganj 1943.

Crop	Jute	Aus	Aman	Jute-Aus	Jute-Aman	Aus-Aman	None	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Jute		1	1				5	5
Aus	1	116	38				19	174
Aman	6	15	52	2		1	5	81
Jute-Aus	1	2	3	4			2	12
Jute-Aman								
Aus-Aman			1					1
None		61	17		1	1	120	200
Total	8	195	112	6	1	2	149	473

Entries by unit 34 (17th - 21st July) —

94. But apart from such genuine mistakes, discrepancies due to gross negligence or due to entries having been made by pure guess work without actual physical examination of the crop also occur. If detailed records are kept it is often possible to detect such mistakes without difficulty. During the Jute-Aus Survey in 1943 we had asked the investigators to note the approximate height of the Jute plant in the grid as a whole. A comparison of the height of the Jute plot as entered during the first and the second survey often shows unmistakable evidence of careless or dishonest work. An example is given in the Table (23) in which col. (1) gives the name of the Police Station; col. (2) the date of the first survey; col. (3) the date of the second survey; and col. (4) the lag in days between the two surveys. The next four columns show the actual differences in height of plants obtained by subtracting the height as recorded during the first or earlier survey from the height as recorded during the second or later survey. These differences should be, of course, positive. Such positive differences in the case of plots for which Jute was shown in both of the surveys are given in col. (5); these are therefore just what one would

Bengal Crop Survey : 1943

Table (23) Comparison of Height of Jute Plants at the first & second survey.

Police Station	Date of Survey: Early	Date of Survey: Late	Lag in days	No.of Plots of height difference (late-early): Jute in both: positive	Jute in both: negative	Jute in one: late	Jute in one: early
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dist - Bogra							
Sherpur	31st May	4th July	34	6	-	6	2
Gabtali	7th June	13th August	59	11	-	17	7
Bogra	13rd June	12th August	59	3	-	7	-
Sonatola	6th June	21th July	43	7	-	13	3
Nilphur	7th June	4th August	43	14	-	8	2
Kahaloo							
Dist - Rajshahi							
Nawabganj	1 th June	1 th August	70	4	-	4	5
Bagha	14th July	6th August	22	4	-	4	2
Rajshahi	30th June	18th July	18	5	0	8	5
Godagari	27th June	28th July	30	3	1	2	3
Dist - Dacca							
Tejgaon	30th June	8th July	7	12	2	2	1
Dist - Faridpur							
Kalkini	31st May	10th June	10	54	2	4	3
Faridpur	2.th July	4th August	15	37	-	19	9
Dist - Jessore							
Sailakupa	8th July	24th July	16	17	4	7	21
Kalia	8th July	14th July	9	15	2	2	4
Narinkunda	17th July	3rd August	17	16	3	9	13
Magura	5th August	17th August	12	32	1	7	1
Sripur	7th August	15th August	8	13	12	-	-
Dt - Midnapore							
Chandrakona	31th July	7th September	38	-	-	-	1

would expect. The negative differences in these cases, which are shown in col. (6), must however be due either to careless or dishonest work. The next two columns show the difference in height of plants for plots which were ~~were~~ shown to be under Jute in only one of the surveys. In col. (8) these differences are given for plots which were recorded as having been under Jute during the second or later survey; these positive differences in height are therefore all physically possible. On the other hand, the figures in col. (9) show the number of plots for which the height of Jute plants was recorded during the earlier survey but which were shown as having no jute crop during the second survey. These discrepancies were most probably due to either careless or dishonest work.

To one

Sub-Sample Test

50. I shall also briefly refer to the sub-sample test for the Area Survey. Relevant data are given in the attached Table (24). The name of the district is given in col. (1). The number of units in each of the

three-stage sampling, namely. (1) Police Stations (or sub-blocks), (2) Sheets (of maps), and (3) Grids, are given respectively in cols.(1) - (4) for Sample (A), in cols. (5) - (7) for Sample (B), and in cols (8) - (10) for Sample (C). The values of the t-statistic by pairs of Sample estimates of the acreage under Jute are given in cols. (11) - (13); and corresponding values for the acreage under Aus paddy in cols. (17)-(19). Probabilities of occurance of observed differences, that is, of observed values of the t-statistic are given in cols. (14) - (16) for the acreage under Jute, and in cols. (20) - (22) for the acreage under Aus paddy. These probabilities are, on the whole, rather high The different sub-samples apparently agree among themselves even more closely than one would expect from statistical theory. This is suspicious and suggests that some of the workers copied portions of the records from one another.

Lack of Experience of the Field Staff

48. It is not necessary to enter into further details or technicalities. The field work in 1943 was not satisfactory in many ways. Apart from difficulties arising from the war or the famine situation the defects in the field survey must also be ascribed to a great extent to the fact that a majority of the field staff were raw recruits who had no previous experience of the work. The position can be easily appreciated from the figures given in the following Tables (25) and (26). In Table (25) col. (1) shows the type of staff; col. (2) the number of persons in each category who joined the field staff after completing the preliminary training; and col. (3) the number who completed their training and were given appointments but did not actually join. The total number of persons who were given training is shown in col. (4), and the number of persons who were not trained in col.(5) and finally the total number who were given appointments in col.(6) The total number of persons who actually joined is shown in col.(7); the number which of persons who resigned of their own accord in col.(8); the number discharged in col.(9); and the number of persons who died while in service in col.(10).

three-stage sampling, namely, (1) Police Stations (or sub-blocks), (2) Sheets (of maps), and (3) Grids, are given respectively in cols.( ) - (4) for Sample (A), in cols. (5) - (7) for Sample (B), and in cols (8) - (10) for Sample (C). The values of the t-statistic by pairs of sample estimates of the acreage are given in cols. (11) - (13); and corresponding values for the acreage under Aus paddy in cols. (17)-(19). Probabilities of occurance of observed differences, that is, of observed values of the t-statistic are given in cols. (14) - (16) for the acreage under June, and in cols. (20) - (22) for the acreage under Aus paddy. These probabilities are, on the whole, rather high. The different sub-samples apparently agree among themselves even more closely than one would expect from statistical theory. This is suspicious and suggests that some of the workers copied portions of the records from one another.

Lack of Experience of the Field Staff

42. It is not necessary to enter into further details or technicalities. The field work in 1943 was not a satisfactory in many ways. Apart from difficulties arising from the war or the famine situation the defects in the field survey must also be ascribed to a great extent to the fact that a majority of the field staff were new recruits who had no previous experience of the work. The position can be easily appreciated from the figures given in the following Tables (25) and (26). In Table (25) col. (1) shows the type of staff; col. (2) the number of persons in each category who joined the field staff after completing the preliminary training; and col. (3) the number who completed their training and were given a posting but did not actually join. The total number of persons who were given training is shown in col. (4), and the number of persons who were not trained in col.(5) and finally the total number who were given appointments in col.(6). The total number of persons who actually joined is shown in col.(7); the number struck of persons who resigned of their own accord in col.(8); the number discharged in col.(9); and the number of persons who died while in service in col.(10).

Table (25) Distribution of Field Staff by (a) Training (b) Joining etc.

Type of Staff	Trained		Total	Not Trained	Total				
	Joining	Not Joining			Appointed	Joined	Resigned	Discharged	Died
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Check Inspector	17	-	17	1	18	18	8	-	-
Inspector	38	-	38	9	47	47	5	1	-
Camp Clerks	20	-	20	5	25	25	-	-	-
Crop Investigators	7	-	7	15	22	22	-	-	-
Investigator	74	69	143	292	435	336	39	16	2
Total	156	69	225	320	545	476	55	17	2

87. It would be noticed that with the meagre resources at our disposal it was possible to give preliminary training to only 225 workers while 320 were not trained. We naturally gave greater emphasis to training the inspecting staff; and fortunately all such trained people actually joined the field staff. But it would be noticed that no less than 69 out of 143 trained investigators did not care to join after completing the preliminary training. Thus although we had given appointments to 545 only 476 actually joined. Among these 476 no less than 55 resigned of their own accord; 17 had to be discharged for unsatisfactory work, and 2 died while in service. This table however does not give a complete picture. Many of the other workers were known to be unsatisfactory and yet could not be discharged as this would have meant replacing them by untrained men who might easily turn out to be still more unreliable.

88. In the present connexion it is of interest to look at the distribution of the staff by years of previous experience. Relevant figures are given in Table (26) in which col. (1) gives the type of staff; and col. (2) the number of workers who were recruited for the first time in 1943 and therefore did not have any previous experience. Successive columns (3) - (8) show the number of workers with experience of one year, two years, etc. up to six years' experience of crop survey work. Looking at the bottom line we notice that out of a total staff of 476 who had actually joined no less than 303 (or about 64 per cent) had no previous experience; 81 had experience of work in one season, 52 of work in two seasons, and only 40 or less than 10 per cent of the total staff had more than two years' experience.

Table (28) Distribution of Field Staff by years of experience

Type of Staff	Experience in years							Total
	0	1	2	3	4	5	6	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Check Inspectors	2	8	3	3	1	1	x	18
Inspector	17	10	8	3	6	x	3	47
Camp Clerks	15	2	5	1	x	x	x	23
Camp Investigators	17	5	36	-	-	-	-	22
Investigators	252	56	-	18	8	1	x	336
Total	303	81	52	25	10	2	3	476

99. It is scarcely necessary to emphasize that the quality of primary work is bound to be poor with a staff the bulk of which is recruited for a short period from year to year. As I have repeatedly pointed out, in order to ensure reliable work it is essential to adopt a long range and build up a permanent or semi-permanent staff.

Experiments in Eye-estimation of Yields per acre

100. Besides crop cutting work on standard lines a new experiment was undertaken in 1943 with a view to exploring the possibilities of using eye-estimates for rapid assessment of the rate of yield. Several years ago similar experiments at Rothamsted and other places in England had shown that carefully selected workers could with training give quite reliable estimates of the yield per acre of wheat by purely visual inspection. In fact, Prof. R. A. Fisher in a note submitted to H. E. the Viceroy in 1938 had recommended that similar attempts should be made in India. Unfortunately, owing to the late decision to take up crop cutting work in previous years, it had not been possible to do any work in this direction for a long time. In 1943 I however decided to make a beginning, and I am glad to note that results have been distinctly encouraging.

101. I thought that the best way of approaching the problem would be to offer prizes for ability to make correct estimates of the yield per acre of Jute and Aus. Sometime before the beginning of the crop cutting work an announcement was made regarding the proposed competition. It was stated that actual tests would be arranged at a number of centres. The workers would be required to make an eye-estimate of the yield per acre for a number of sample-cuts by visual examination. These sample-cuts would be then actually harvested and the crop weighed by the examiner in charge with the help of the examinees themselves. Cash

prizes varying from Rs.10 to Rs.100 were offered for ability to make reliable eye-estimates. All crop cutting workers were invited to participate in the competition. The response was very satisfactory : 140 workers took part in it, and among them 31 workers were awarded cash prizes.

Eye-estimates of Yield

102. I shall now consider the results of the eye-estimate tests. Table (27) gives the estimates of the yield of Jute and Aus made by purely visual examination by a number of the more competent workers. In this Table col.(1) gives the serial number of the sample-cut of size 8' X 8' for Jute and 4' x 4' for Aus paddy. Col. (2) gives the yield (in terms of maunds of dry fibre per acre) of each. The corresponding eye-estimates of the yield made by worker No.5 is shown in col. (5); and the eye-estimate made by other workers in successive columns (4) to (7). In the same way, col. (8) gives the yield per bigha of Aus rice (not in husk) as determined by direct weighing by the examiners themselves. The corresponding eye-estimates made by a number of workers are given in col. (9) to (13).

Sample-cut as determined by actual weighing by the examiners themselves

Table (27). EYE-ESTIMATES OF YIELD PER BIGHA.

Sample No.	Dry fibre of Jute in mds per bigha. Pabna Cluster.						Aus rice (not in husk) in mds.per bigha Pabna Cluster.					
	Measured by Examiner	Eye-estimates by worker					Measured by Examiner	Eye-estimates by worker				
		No.5	No.6	No.9	No.11	No.12		No.6	No.9	No.11	No.12	No.14
(1)	(2)	(3.1)	(3.2)	(3.3)	(3.4)	(3.5)	(4)	(5.1)	(5.2)	(5.3)	(5.4)	(5.5)
1	7.[illegible]	5.25	6.[illegible]	5.[illegible]	6.50	6.[illegible]	0.92	2.[illegible]	1.[illegible]	[illegible]	1.56	1.69
2	8.2[illegible]	4.00	5.00	6.50	6.[illegible]	4.[illegible]	[illegible].29	2.00	2.00	1.[illegible]	[illegible].75	1.75
3.	[illegible].5	3.00	2.75	4.[illegible]	[illegible].00	3.[illegible]	5.60	2.38	2.25	3.[illegible]	[illegible].38	2.25
4	8.37	7.00	7.[illegible]	8.[illegible]	10.50	8.00	1.22	0.75	0.75	0.[illegible]	0.[illegible]	0.56
5	9.[illegible]	8.50	7.50	9.[illegible]	9.[illegible]	9.[illegible]	3.06	2.50	2.65	4.[illegible]	2.63	1.75
6	8.46	8.00	9.5[illegible]	8.5[illegible]	9.50	9.00	1.84	1.75	1.75	1.1[illegible]	1.13	1.13
7	5.[illegible]5	5.50	4.50	3.00	5.5[illegible]	4.50	3.[illegible]8	3.25	2.25	3.75	4.38	4.[illegible]0
8	5.[illegible]8	7.00	7.50	7.00	3.[illegible]	8.00	2.45	1.38	2.13	2.[illegible]	[illegible].38	3.65
9.	5.77	4.50	6.50	5.50	4.50	6.00	3.[illegible]6	3.75	3.75	4.[illegible]	4.[illegible]5	4.75
10.	4.[illegible]3	6.[illegible]	7.00	6.[illegible]	5.50	6.[illegible]	3.44	4.25	[illegible].[illegible]	4.[illegible]	3.75	3.75
11	5.74	8.[illegible]	8.[illegible]	8.[illegible]	7.75	7.50	5.05	4.75	4.50	5.75	5.50	5.25
12	4.39	7.00	7.00	8.50	7.60	6.00	3.90	5.00	4.38	4.75	5.[illegible]	3.75
13	9.[illegible]	10.50	9.50	11.[illegible]	9.50	10.00	2.75	3.[illegible]8	4.25	3.7[illegible]	3.00	3.[illegible]6
14	6.[illegible]5	7.50	6.50	6.50	7.50	6.50	0.84	[illegible].70	1.25	0.75	0.78	0.19
15	7.04	7.00	5.5[illegible]	6.50	6.50	6.50	0.69	0.63	1.20	0.[illegible]	0.63	0.81
16	5.[illegible]6	5.50	6.[illegible]	6.00	6.5[illegible]	6.00	0.88	0.75	0.88	0.40	0.[illegible]	0.88
17	7.04	7.25	8.00	7.[illegible]	7.50	5.50	0.85	0.88	0.95	1.25	1.63	0.81
18	5.87	5.00	4.00	4.00	6.50	4.00	1.61	1.50	1.50	2.00	1.88	1.98
19	2.[illegible]	3.25	3.50	3.[illegible]	3.50	3.50	1.91	2.63	2.88	3.[illegible]	[illegible].25	2.75
20	[illegible].85	4.[illegible]	4.[illegible]	4.[illegible]	4.[illegible]	4.00	1.45	1.35	1.75	1.25	1.88	1.65
Total	6.21	6.12	6.16	6.5[illegible]	6.51	6.22	2.1[illegible]	2.[illegible]5	2.[illegible]4	2.41	2.54	2.36

105. It would be noticed that eye-estimates made by the more competent workers are on the whole good. Estimates for individual sample-cuts naturally varied to a considerable extent. But a glance at the bottom line which gives the average values would show that the agreement between the mean value as obtained by direct measurement and the mean values of eye-estimates made by different workers is quite satisfactory. For example, for Jute, the mean value for the sample-cuts shown in the present Table was 6.21 maunds of dry fibre per bigha. The corresponding mean values of eye-estimates made by the different workers were 6.16, 6.51, 6.22, 6.58 and 6.12 maunds per bigha. For Aus, against a mean value of 2.15 as directly determined by the examiner, we have mean values of eye-estimates made by different workers of 2.55, 2.34, 2.41, 2.54 and 2.58 maunds per bigha.

106. The results show conclusively that there are workers who are capable of making eye-estimates with sufficient accuracy for all practical purposes. Such workers however cannot be secured by ad hoc appointments. They must be carefully selected and must be given necessary training extending not over one season but over several. Provided this can be done, there is no reason why we should not be able to obtain a good number of reliable workers capable of making accurate eye-estimates of yields.

107. I may note here that besides judging the possibility of making reliable eye-estimates I had another purpose in view in arranging the competition. I thought that as the prizes offered were quite attractive at least some of the workers would try to train themselves in making correct estimates by actually weighing the crop carefully while they were engaged in routine crop cutting work. This would, of course, improve the general quality of crop-cutting work. On the whole, the Supervisors and Examiners were of opinion that many of the workers had taken considerable care in weighing the crop correctly at the time of their routine work in order to get experience of making eye-estimates.

108. The results of the present experiment are, therefore satisfactory from every point of view. The possibilities are great. The time taken for making eye-estimates would be of course only a very small fraction of that required for cutting the crop and weighing it. There is therefore no difficulty in a worker making eye-estimates of yield for 20 or even 40

or 30 different plots in a village in the course of/day. If we take the average of these 20 or more eye-estimates relating to a particular village it is clear that we are likely to get a reliable value of the yield for the village as a whole.

107. It is possible that particular individuals may have special aptitude for making reliable eye-estimates just as we know that particular individuals have a special abi ity to judge the quality of tea by tasting. A careful selection of workers with such special ability may therefore be necessary. But if we can secure a number of such workers with a flair for making reliable eye-estimates of the yield of Jute or Paddy, and if such workers are given suitable training, and finally (this is the crux of the whole matter) if these workers can be relied upon to do their work conscientiously then there would be no difficulty in securing reliable eye-estimates of yield per acre over the whole province. Each such trained worker would simply have to move from village to village, and in the course of his journeys make a systematic note of the yield of say from 20 to 50 plots per village (which can be easily selected beforehand by a suitable random procedure in the Statistical Laboratory). In this way each worker would probably be able to collect information for about 20 villages in the course of a month. With 50 such workers it would be then possible to collect information for about 1000 villages all over the province which would probably be adequate for all practical purposes.

108. I am not suggesting that we should rely entirely on such eye-estimates. It would be most certainly necessary and desirable to continue crop-cutting work on usual lines to supply an objective check on the reliability of the eye-estimates, and also to furnish an independent estimate on which one would always be able to fall back in case the eye-estimates system was not working properly. The eye-estimate experiments made in 1945, however, conclusively demonstrate the great possibilities of this method.

109. In order to develop this method it is however, absolutely essential to ensure continuity of work by persons who have any special ability in this direction. This, in its turn, can only be secured by continuity of employment. In other words, the only possible line of advance in future

appears to be to build up gradually a nucleus of reliable crop-cutting workers. This staff need not be very large. Something of the order of say 10 workers would be probably quite sufficient. These workers would be actually engaged in crop-estimating work in the field by (a) crop cutting work on usual lines and also (b) by eye-estimation in the June and Aus seasons roughly during the three months : July, August, and September, and for about two months in the Aman addy season from about the middle November to the middle of January. They would be thus employed in crop-estimating work for about 5 months. They could have to be given leave say for about a month; and would be thus free for about six months in the year for other work. They can usefully do area survey work for about two months in the June-Aus season and for about a month in the Aman season which would leave a balance of about three months in the year during which they can be conveniently utilised for preparatory and other statistical work in the statistical laboratory. There is therefore not the slightest difficulty in employing such men on a whole-time basis throughout the year.

110. I have been making experiments with crop cutting work now for about 5 years. From a carefully scrutiny of the material and from impressions gathered in the course of the work I have absolutely no doubt in stating that much of the material collected every year has been thoroughly unreliable. I do not see any possibility of securing reliable information relating to the yield of crops unless and until a fairly permanent body of trained crop cutting workers is built up. I give it as my considered opinion that to do anything else would be wasting money, time, and effort.