BENGAL CROP-CUTTING EXPERIMENTS, JUTE 1941

(1) Introductory

(1) General

A three year scheme for the development of a suitable technique for estimating the yield-rate per acre of jute in Bengal, was started in 1941. The scheme was jointly financed by the Government of Bengal and the Indian Central Jute Committee, while the entire field work and the statistical analysis was entrusted to the Indian Statistical Institute,

The experiments were carried out in 40 selected Police Stations in eight principal jute growing districts of Bengal, by a field team consisting of 51 investigators and 5 inspectors.

The entire survey, which was purely of an exploratory nature, had been broadly divided into seven different schemes, conducted in different regions under separate field parties, and the total number of cuts thus collected numbered 4778. The following would give the period of work in the different districts, together with the number of Police Stations and villages worked in and the number of investigator inoperation.

Table 1. Statement of field work

Districts	Number of					Period of work
	Police stations	Villages	Cuts	Sub-cuts	Investigators.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Bogra	3	23	76	100	4	26/8 - 23/9
Dacca	5	56	238	806	7	26/8 - 29/9
Dinajpur	3	11	74	185	5	1/9 - 20/9
Faridpur	5	91	491	1363	6	25/8 - 20/9
Mymensingh	7	126	422	806	10	26/8 - 24/9
Pabna	1	15	79	567	2	25/8 - 22/9
Rangpur	15	157	627	939	16	26/8 - 21/9
Tippera	1	11	12	12	1	27/8 - 22/9
Total	40	490	2019	4778	51	25/8 - 29/9

(2) Objects of the various schemes.

Each scheme was designed with an eye to a specific study, not by extensive operations over the length and breadth of the province, but by intensive small scale experiments by a trained staff under the strictest supervision and control. In drawing up the various schemes, the following items had to be kept in view for study.

(a) Patterns of Multistage Sampling, as an extension of the few tried in'40

6 (i) For each pattern, determination of the contribution of the sampling error of the estimated means at each stage, towards the final precision of the grand mean.

(ii) Determination of the field cost involved in each pattern and test of the efficiency of each pattern in terms of precision pe unit of cost.

(b) Size of cuts

(i) Variance within villages as a function of the size of cut.

(ii) Cost Function corresponding to different sizes of cuts.

(iii) Positive bias in cuts of very small size, first detected in the experiments of 1940, and quest for the smallest size which might be practically free from perimeter bias and other defects.

(c) Peculiarity in the borders of plots

Differential yield rate along the borders of a plot.

(d) Study of the concomitant variates.

Correlation, of the weight (per unit) of dry fibre with certain auxiliary characters, study as to how far the correlation (which was fairly high) between such characters (based on individual plants) found from a uniformity trial material of 1940 from the Dacca Agricultural farm pesists when we reckon cuts as a whole instead of individual plants.

(3) Designs.

The following Table (2) describes the designs of sampling aplied in each of the various schemes, in order to achieve one or other of the specific objects already enumerated. Broadly spaking, the main object of the schemes, I,III,IV and VI was to study the cost and precision under different patterns of stage sampling, the schemes II and V were designed to study the cut size as affecting the variance, the enumeration cost and the extent of bias, while the scheme VII was intended primarily for the study of concomitant variates and carrying of retting operations.

Table 2. Description of different sampling schemes

Scheme	Schemes of Sampling	Number of Police stations	Centres	Villages	Plots	Cuts	Sub-cuts
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
I	(a) Multiple cuts-full size 15'x15' at one cut per plot	3	3	26	52	104	936
II	(b) Multiple cuts-full size 15'x15' at two cuts per plot	4	4	34	185	185	1665
II	Independent square cuts 3'x3', 5'x5', 7'x7', 8',8', 12'x12' and 15'x15' one cut per plot, one size only in a village	3	3	41	173	173	173
III	Maximum plots per village, one 7'x7' simple cut per plot with various days of haltage at different centres	3	15	21	278	278	278
IV	Maximum villages with 2 plots per village and two 7'x7' simple cuts per plot with various days of haltage at different centres	3	15	87	199	312	312
V	Multiple cuts rectangular and square	14	30	41	152	298	745
VI	0 One mouza per centre, three plots per villages, one 7'x7' simple cut per plot	7	93	107	371	371	371
VII	Square cuts of sizes 3'x3', 5'x5', 7'x7', 8'x8', 12'x12', 15'x15' for retting	14	14	133	298	298	298
	Total :	51	177	490	1708	2019	4778

II. Results of the Experiments

(a) Multistage Sampling.

It is needless to emphasize that the technique of crop-cutting, is by its very nature, a technique of multistage sampling and unlike an area survey cannot be conceived as a single unistage one, for the following obvious reasons :-

(i) The complexities of technique and the high cost of operations involved in crop-cutting compared to the area survey work demands the services of a highly trained staff. Such a staff must necessarily be a small one and consequently would have to be on the move, so as to cover as many centres as possible. Besides the difficulties of assembling a big staff of suitable calibre there are other difficulties on administrative side as well. This staff must be given an employment all the year round, but this cannot usually be provided for, in a scheme of crop-cutting lasting for a month or two only in the year. As a consequence, a portion of the staff, engaged in the area survey work, which continues right up to the harvesting peiod, has to be diverted to crop cutting. It is mainly for this reason that a big number of trained personnel cannot be in practice mobilised for the crop cutting expeiments.

(ii) The relatively short pwiod available for the harvest survey in a particular locality and the uncertainty of predicting the exact period in which a crop would be ready for harvesting would make the ara survey tehnique unsuitable in this case.

(iii) The staff, which must be on the move as frequently as they can, must nevertheless have a reasonable minumum period of stay, not too short compared to the preliminaries involved in finding a camping house and arranging for food. On the other hand, a minimum scheduled haltage of a week in each centre for instance, would give us numerous cuts per centre while the total number of centres because of longer haltages would consequently be limited, thus resulting in a clustured pattern of crop-cutting.

Within a centre again, it is not often practicable to draw sample plots in a single drawing over all the villages, nor could the plots thus selected be cut completely. Thus, within each centre selected in the first stage, village would have to be selected in the second and finally the samplecuts within a plot would have to be located at random.

It is therefore of the utmost importance, to estimate the variance in each stage and evaluate the corresponding costs for each pattern of stage sampling. This would give us as a first approximation, the typeof pattern which would lead to a maximum of precision at any given level of expenditure.

Table (3) below gives the analysis of variance in stages for each scheme, while Table (4) shows the estimated standard deviation at each stage, as also the standard error and the percentage variability of the grand mean. The mean values are shwn within brackets at the head of the respective columns.

Table (3) Analysis of variance : weight of green plant of jute in maunds per acre (based on cuts of size 7' x 7')

Sources of variations	Degrees of Freedom				Observed Variance			
	*I(b)	III	IV	VI	I(b)	III	IV	VI
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Between Centres (or P.S.)	3	2	3	6	41384	45150	32493	47362
Within Centres Between village	-	12	30	81	-	19057	8480	16878
Within village between plots	-	263	47	204	-	4438	8124	5294
Residual	181	-	81	-	4643	-	98	-
Total ; (between cuts)	184	277	161	351	5242	5333	4607	8687

* Between village within centre variance not significant.

Table (4) : Estimated standard deviation of the stage means in maunds of green plants per acre.

Sources of variation	Standard Deviation			
	I(b)	III	IV	VI
Mean	(228)	(240)	(244)	(214)
(1)	(2)	(3)	(4)	(5)
Between centres (or P.S.)	29.2	15.6	22.4	25.9
Within centres between village	-	29.8	8.7	53.8
Within village between plots	-	66.6	63.4	73.8
Residual between cuts	68.3	-	9.9	-
Standard error of grand mean	16.0	15.9	13.8	14.1
Percentage Variability of grand mean	6.99	6.63	5.63	6.59

Table (5) again gives the percentage variability of the grand mean, total cost of field operation in man-days and their product (an index of the efficiency of the sampling scheme) for each of the above schemes (shwn by haltages in case of the schemes III & IV).

Table (5): Efficiency of the various schemes based on cuts of size 7' x 7' (in maunds of green plant per acre)

Schemes	Days of haltage	Number of sample units per stage					Percentage variability	cost in M-days	Efficiency Index
		P.S./Centre	Vill.	Plots	Cuts	Mean			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
I	-	7	60	237	289	228	6.99	173	1209
III	2	3	3	17	17	223	11.08	8	89
	3	3	3	29	29	224	10.28	11	113
	4	3	5	42	42	220	8.69	14	122
	5	3	5	74	74	245	7.20	17	122
	6	3	5	116	116	248	6.95	20	139
IV	2	3	8	16	22	383	8.50	8	68
	3	3	15	29	46	292	7.24	11	80
	4	3	18	40	63	330	6.77	14	95
	5	3	23	54	94	245	6.42	17	109
	6	3	23	60	87	267	6.32	20	126
VI	-	93	107	371	371	214	6.59	21	138

It will be seen that in both the schemes III & IV, there is no apreciable improvement in the precision of the estimate, beyond the haltage of 4 days per centre notwithstanding an increase of tho total number of sample cuts. But, scheme IV, a sample with the maximum number of villages and with only two plots per village in the different haltages of 2, 3, 4, 5, 6, days, is on the whole more efficient than scheme III, a sample of maximum plots per village in 2, 3, 4, 5, 6, days of work in each haltage. The cost per unit of information is lowest, as may be expected, in the sample obtained in the lowest haltage.

Scheme I, with a multiple cut, is a different pattern altogether which is again too costly for repetition. Scheme VI gives an estimate over a wide extent of area covering 7 Police Stations (in four different districts) and its percentage variability is quite high in relation to the cost of operations.

A glance at Table (4), would at once reveal that the contribution of various stages, towards the error of the grand Mean is predominantly made by the variability between centres, with the smallest divisor in theseries, being the number of centres. The variability of the centre Means, so far observed are found to be near about 10%. To arrive at an estimate of the grand mean within a percentage variability of 1%, it would thus require an extensive sampling in at least 400 centres, with a similar distribution per centre.

(b) <u>On size of cuts.</u>

(i) <u>Variance Function.</u> The following Table (6) gives the Mean, Variance and Coefficients of variation observed within sampled villages based on the various sizes of cuts, as per schemes I and II, shown side by side.

A general fall in the variance, sharp at the beginning and more and more gradual later, would be observed in each case. In the case of scheme II, however, the results are most irregular with respect to the Mean, as also to the Variance. The multiple cuts in Scheme I, on the whole gives a better picture of the trend, while the different sizes in scheme II being independent cuts in altogether different villages, and also only few in number really blur the underlying picture. The coefficients of linear regression (g) of the observed variance on the size of cut, in a double logarithmic scale is appended at the foot of the Table. The coefficient is much lower than unity, indicating that the fall in variance, consequent on an increase in size, is very small and much less than what could be expected, if the yield rate were distributed at random over the plots.

Table (6): Observed Mean and Variance, based on different sizes of cuts in schemes I and II (in maunds of green plants per acre).

Size of cuts	Number of cuts		Mean s.e.		Variance	
	I	II	I	II	I	II
(1)	(2)	(3)	(4)	(5)	(6)	(7)
3' x 3'	185	29	278 ± 16	442 ± 33	12609	
3' x 5'	185	34	241 ± 12	203 ± 17	7969	2906
7' x 7'	185	20	228 ± 16	166 ± 18	4643	999
8' x 8'	185	30	254 ± 7	279 ± 24	7945	944
12' x 12'	185	40	231 ± 14	218 ± 12	4565	328
15' x 15'	185	20	239 ± 13	220 ± 25	4501	665
			$V = a(x)^g$		g = 0.31 a = 22701	g = 0.75 a = 23210

(ii) Cost Function. Table (7) again gives the cost of enumeration incurred in scheme II against each size of cut in hours per cut. The cost should increase with an increase in the size of cut, but the results obtained are anomalous, owing probably to the very smallness of the data. Table (8) shows the main components of cost namely journey, enumeration, miscellaneous work and overhead hours per cut and as percentage to total. It would appear that the percentage of hours utilised in actual enumeration is very low while the journey time occupies near about 30% of total. The total cost in hours per sample cut naturally falls with an increase in the haltage as given out in case of both the schemes III and IV.

The nett enumeration time available for crop-cutting is therefore quite precious and the best use has to be made of this component to work at a high level of efficiency.

Table (7): Enumeration time in hours per sample cut, depending on the various sizes of cuts, as in scheme II.

Size of cuts	Total cuts	Enumeration hours per cut
(1)	(2)	(3)
3' x 3'	28	0.86
5' x 5'	29	1.25
7' x 7'	10	0.74
8' x 8'	26	0.90
12' x 12'	28	0.95
15' x 15'	12	1.25

Table (8): Components of Field Cost

Components	Hours per sample cut in haltages of					Percentage to total				
	2days	3days	4days	5days	6days	2days	3days	4days	5days	6days
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Scheme III. Hours per sample cut ; five centres eight miles apart ; Maximum plots per village at one cut(7' x 7')per plot.										
Journeys	7.94	2.89	2.55	1.44	1.34	40.2	29.1	31.9	26.1	35.2
Enumeration	1.16	0.90	0.89	0.31	0.29	5.9	9.1	11.1	5.6	7.6
Miscellaneous	1.36	0.70	0.66	0.46	0.31	6.9	7.0	8.3	8.4	8.1
Overhead	9.28	5.44	3.89	3.30	1.87	47.0	54.8	48.7	59.9	49.1
Total :	19.76	9.93	8.00	5.51	3.81	100.0	100.0	100.0	100.0	100.0
Scheme IV: Five centres eight miles apart : maximum village at 2 plots per village and two cuts (7' x 7') per plot.										
Journeys	2.28	2.06	1.05	1.07	1.49	23.2	23.3	22.9	26.0	24.6
Enumeration	0.42	0.58	0.46	0.36	0.47	4.3	6.6	10.0	3.7	7.8
Miscellaneous	0.48	0.32	0.17	0.10	0.19	4.9	3.6	3.7	2.4	3.1
Overhead	6.65	5.89	2.90	2.58	3.91	67.6	66.5	63.4	62.9	64.5
Total :	9.83	8.85	4.58	4.10	6.07	100.0	100.0	100.0	100.0	100.0

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(iii) **Perimeter bias:** In order to confirm our findings of 1940, regarding the occurrence of a small amount of overestimating tendency in the case of very small cuts, we have investigated into the same phenomenon again this year, over various sizes ranging from 3' x 3' to 15' x 15'. The gradual decline as shown in Table (6) in the estimated Mean with increase in size, persists up to 5' x 5' and then the estimate assumes a comparatively steady value, Our object is to hit upon the most economical size, neither too small, to render the estimates biased nor too big to be inefficient in other respects, for instance of such demensions as would prohibit a free and fair representation of all the portions of the plot which may be thecase with too big in size.

(c) Peculiarities of the plot borders.

(i) Our next study relates to investigation as to whether there existed any peculiarity in the growth of crops along the borders of a crop plot. It is a matter of every day experience that a narrow strip of area running between the 'ails' and the crop-front often goes practically barren or yields a very poor crop. A marked gradient from a lower to a higher yield rate, as we proceed from the 'ail' towards the centre, is also generally noticed. This is being corroborated objectively, though not conclusively, because of the smallness of material, by the following results, shownin Table (9). Rectangular sample cuts of three different sizes, measuring 2.5' x 10', 3.5' x 14', 5'. x 20', the longerside starting from the 'ail' itself and proceeding inwards, were harvested in the shape of four equal and square sub-cuts. The mean yield rate as estimated by the various sub-cuts as they recede from the ail goes up and then becomes steady as the centre is approached. The general mean representing the entire plot based on square shaped cuts of size 10' x 10' comes to 191 mds. per acre against 184 mds. based on the rectangular cut of size 5' x 20', which gives the mean yield rate over a strip, 20 feet in depth around the perimeter, This again shows that the latter is lower than the general mean by 3.7% . The size 100 sq. ft., we consider, may be safely assumed to be so large as to be practically free of bias, so that the rectangular cut 5 x 20 may be considered to be comparable with one 10 feet square.

Table (9): Gradient of yield rate from the ail towards the centre.

Size of cut : 2'.5 x 2'.5 of sub-cuts (m = 44)			Size of cut : 3'.5 x 3'.5 of sub-cuts (n = 57)			Size of cut : 5'.0 x 5'.0 of sub-cuts (n = 50)		
distance from ail(ft)	mean in mds.per acre	Index	distance from ail(ft)	mean in mds.per acre	Index	distance from ail(ft)	mean in mds.per acre	Index
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1.25	218	100	1.75	168	100	2.50	162	100
3.75	267	124	5.25	207	123	7.50	183	113
6.25	291	134	8.75	227	135	12.50	196	122
8.75	305	140	12.25	220	131	17.50	194	120
Mean for the total plot, sampled by square cuts (10' x 10')						191	12	100
Mean for the border 20' in depth sampled by rectangular cuts (5' x 20')						184	10	96

It is therefore a strong pointer to the fact that the crop distribution has a marked pattern and randomness in the selection of cut has got to be cautiously safe-guarded. Any system of random location, which does not properly represent the borders is apt to give vitiated results on this account.

(d) Study of the con-comitant variates.

The scheme VII was aimed specially at the study of the use of concomitant variates in working out the regression formulae for arriving at the ultimate estimates, namely the yield rate in terms of dry fibre. A number of auxiliary characters, such as the height of individual plants, girth at foot, density of plants in the cut etc. were also recorded in Scheme I, but only the weight of green plants were collected xxx and no retting was done.

Our investigations into the uniformity trialdata of the Dacca Agricultural Farm in 1940, showed that there wasan intrinsic high correlation, of the weight of dry fibre not only with the weight of individual plants, but also with the height and density of plants and the girth measurements.

Our object this year was to find out the extent of correlation that existed between these characters based not on individual plants, but on the average of these characters over the individual sampling units or cuts. The measurements of (1) height (2) girth at foot were taken for each tenth plant in Scheme I, out of each sample cut (after harvesting), but in Scheme VII only a fixed number of plants selected at random were measured. Thus while the plants measured in Scheme I was proportional to the total number and gave a measure of the density of plants per unit of area, the same was not true in case of Scheme VII. Treating the variation of individual plants within a cut as negligibly small, we have calculated the following correlation coefficients based on the sample means as the fundamental variates.

Table (10) : Correlation Coefficient and Coefficient of regression based on sample cuts of size 3' x 3'.

Independent Variates	Correlation of yield of dry fibre: Sample cut (52) scheme VII r	Correlation of yield of dry fibre: Individual plant(998) Dacca Farm 1940 r	Correlation of yield of gr. plant: Sample cut (101) Scheme I r
(1)	(2)	(3)	(4)
Weight of gr.plant per S.Cut	0.874 **	0.934 **	-
Mean height (h) " "	-	0.776 **	0.635 **
Mean girth (g) " "	0.488 **	-	0.205 *
Weight of gr.plant and M.height	0.875 **	0.935 **	-
Weight of gr.plant and M.Girth	0.915 **	0.874 **	-
Mean Height and Mean girth	0.489 **	-	0.687 **

** significant at 1% level, * significant at 5% level.

It would be seen that the weight of dry fibre is very highly correlated with the weight of green plants being 0.874.

Multiple correlation coefficient of dry fibre with the weigh of green plants and the average height do not give much improvement over the correlation with the weight of plants alone,. Similaly the multiple correlation of dry fibre with height of plants and girth at foot brings no improvement over the correlation with height alone.

It appears that a more precise enquiry into the correlations of yield with other concomitant characters may be worthwhile to pursue, which would, of course, necessitate the use of moderate size cuts.

Simple correlation of the dependent variate namely the actual yield with one or other of these auxiliary characters irrespective of dimensions involved is thus not found to be very high, except that of dry fibre with green plants. Multiple correlation in various combinations among the characters also produce no marked improvement. Treating the total of the heights of all plants in a cut or the product of density average height (d x h) as a new variate, we note that the correlation of green plant is .4592. Since only 10% plants were measured, this variate is really proportionate to the true total integrated over all the plants in the cut.

Similarly the total of the products of height and girth (at foot) over all the plants in a cut, for which these have been recorded and which is proportionate to the total surface of bark per cut, has been directly correlated with green plants, giving a coefficient of 0.642. Similarly, the correlation of green plants with

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taken over a cut, which is proportionate to the total volume of the plants is found to be 0.451 and the results are shown below :

Independent variate	Correlation of green plants in scheme(I) 3' x 3' cuts
1. $\bar{h}$	0.612
2. $\bar{h} \times \bar{g}$	0.536
3. $\bar{h} \times (g)^2$	0.669
4. $\Sigma h = d\bar{h}$	0.539
5. $\Sigma(hg) = d\bar{hg}$	0.642
6. $\Sigma(hg)^2 = d\bar{hg}^2$	0.451

The correlation is thus considerable, when all the three, namely, the number or density of plants, height and girth are simultaneously considered. The product variates which are expected to give higher correlation coefficients are however showing no improvements in our case. This is most likely due to the general tendency of the investigators to take the measurements for a number of plants not truly proportionate to the total number.

It may be noted that the measurements on which Table (10) is based, are what can in practice be recorded on the field before actual harvesting. It is not practicable for instance, to measure a given proportion of plants while standing, unless each plant is exhaustively measured and marked out, which may be feasible only when the sample cut is small. So far as the regression coefficients are concerned it is however immaterial, whether any bias resides in the recording which is likely to affect both the variates equally.

Ratio of dry fibre to the weight of green plants

Table (11) gives the average ratio of the weight of dry fibre to that of green plants, given by the retting experiments in Scheme VII, for each of the Police Stations worked in, based on cuts of size 3' x 3' and 15' x 15'.

Table (11) Ratio of dry fibre to green plant (Scheme VII)

Srl. No.	Police Station	No. of cuts		Ratio of Dry fibre to green plant based on size	
		3' x 3'	15' x 15'	3' x 3'	15' x 15'
1	Jamalpur	4	4	.0609	.0784
2	Mymensingh	2	3	.0912	.0818
3	Iswarganj	5	-	.0705	-
4	Gafforgaon	2	1	.0507	.667
5	Ullapara	3	2	.0695	.0623
6	Kaliganj	4	4	.0630	.0629
7	Munshiganj	4	4	.1002	.0696
8	Chandpur	2	2	.0344	.0535
9	Bhanga	4	5	.0572	.0757
10	Gabtali	6	6	.0762	.0737
11	Faridpur	5	5	.0601	.0667
12	Joypurhat	4	4	.0630	.0767
13	Palashbari	5	5	.0709	.0799
14	Domar	2	2	.0640 -	.0750
		52	45	.0698 ± .0027	.0723 ± .0019
	Regression coefficient b			.0693 ± .0021	.0664 ± .0023

It will be seen that the mean ratio is very nearly the same as the regression coefficient 'b' in the relation y = bx and shown at the foot of the table.

III. Appendix.

It is not possible to utilise all the materials collected in these experiments to estimate the mean yield of the various localities visited together with the margin of errors, because of the diversity of the designs and variety of the size of sampling units applied.

The following table A(1) however gives the estimates of Mean yield of green plants in maunds per acre for each Police station, based on sample cuts of size 7' x 7' alone, except for Scheme II, where the actual sizes used have been noted at the foot of the Table. The number of cuts thus selected is very small and the estimates naturally have got a very high margin of error not shown in the Table. Col.(6) of the same table gives the converted yield rates in terms of dry fibre, using an overall ration of .0693 obtained in Scheme VII (Table 11).

The average yield rate for the eight principal jute growing districts in the year 1941 weighted by the district acreages under jute in the year and shown in Col.(2), thus comes to 17.1 in maunds of dry fibre per acre.

Table A(1) : Mean yield rate by Police Stations, based on cuts of size 7' x 7', except those from Scheme V being on 10' x 10'

District	Acreage in(000) under jute.	Police Station	Scheme No.	No.of cuts.	Mean yield in mds. per acre	
					Green plant	Dry fibre (b-.0693)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Bogra		Jpypurhat	V & VII	5	154	10.7
		Gabtali	VII	6	124	8.6
		Panchbibi	V	3	174	12.0
District	53.2			14	145	10.1
Dacca		Munshiganj	I	44	279	19.4
		Joydevpur	I	31	275	19.1
		Kaliganj	III & VII	34	207	14.3
		Sibalaya	IV	72	340	23.6
		Keraniganj	II	3	196	13.6
District	145.8			184	287	19.9
Dinajpur		Kumarganj	V	2	284	19.6
		Nawabganj	V	8	230	16.0
		Phulbari	V	4	226	15.6
District	65.0			14	236	16.4
Faridpur		Char Bhadrasan	I	55	207	14.5
		Goalundoghat	I	54	230	16.0
		Nagarkanda	III	175	238	16.5
		Faridpur	IV & VII	167	244	16.9
		Bhanga	VII	4	213	14.8
District	146.3			455	235	16.2
Mymensingh		Jamalpur	I & VII	23	267	18.1
		Iswarganj	I & VII	33	231	16.0
		Kishoreganj	II	4	183	12.7
		Netrokona	II	10	235	16.3
		Gaffargaon	III & VII	85	257	17.8
		Sarishabari	IV	68	313	21.7
		Mymensingh	VII	2	89	6.2
District	323.2			225	268	18.6
Pabna	73.2	Ullapara	I & VII	64	222	15.4
Rangpur		Palashbari	VII	7	140	9.7
		Mitapokhar	V	5	256	17.7
		Badarganj	V	21	221	15.3
		Kaunia	V	1	150	10.4
		Pirgacha	V	3	256	17.7
		Saidpur	VI	12	212	14.7
		Pirganja	V	12	263	18.2
		Sadullapur	V	2	223	15.4
		Gobindaganj	V	3	209	14.5
		Sundarganj	V	3	223	15.5
		Domar	VI	35	257	17.8
		Nilphamari	VI	76	225	15.6
		Jaldhaka	VI	128	191	13.2
		Dimla	VI	36	269	18.0
		Kishoreganj	VI	56	188	13.0
District	190.2			400	214	14.8
Tipperah	143.3	Chandpur	VII	2	271	18.7
Eight districts	1140.2			1358	247	17.1

sp/6-7-51.