A SAMPLE SURVEY OF CANE FARMERS SUPPLYING CANE TO CARONI LTD.

Vol. 1

Note (Vol. 2: tables by R.O. Bohn, et al. issued separately)

J. P. MARTEL, B. Sc.

D.T.A. Report.

Submitted in part fulfilment of the requirements for the Diploma in Tropical Agriculture of the Imperial College of Tropical Agriculture, Trinidad, W.I.
<table>
<thead>
<tr>
<th>CONTENTS</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>PART I. INTRODUCTION</td>
<td></td>
</tr>
<tr>
<td>1.1 General Introduction</td>
<td>1</td>
</tr>
<tr>
<td>1.2 Type of Survey</td>
<td>2</td>
</tr>
<tr>
<td>PART 2. THE FRAME AND SAMPLING USED</td>
<td>3</td>
</tr>
<tr>
<td>2.1 The Frame</td>
<td>3</td>
</tr>
<tr>
<td>2.2 Stratification</td>
<td>3</td>
</tr>
<tr>
<td>2.3 Calculation of the Sampling Fractions</td>
<td>4</td>
</tr>
<tr>
<td>2.4 Drawing the Sample</td>
<td>6</td>
</tr>
<tr>
<td>PART 3. DEFECTS OF THE FRAME AND SPECIAL CASES</td>
<td>6</td>
</tr>
<tr>
<td>3.1 Introduction</td>
<td>6</td>
</tr>
<tr>
<td>3.2 Inaccurate Frame</td>
<td>7</td>
</tr>
<tr>
<td>3.3 Incomplete Frame</td>
<td>7</td>
</tr>
<tr>
<td>3.4 Frame Subject to Duplication</td>
<td>7</td>
</tr>
<tr>
<td>3.5 Out of Date Frame</td>
<td>8</td>
</tr>
<tr>
<td>3.6 Inadequate Frame</td>
<td>8</td>
</tr>
<tr>
<td>3.7 Conclusions on the Frame and Special Cases</td>
<td>9</td>
</tr>
<tr>
<td>PART 4. PRELIMINARY ORGANISATION OF THE SURVEY</td>
<td>10</td>
</tr>
<tr>
<td>4.1 Mapping of the Sampled Units</td>
<td>10</td>
</tr>
<tr>
<td>4.2 The Questionnaire</td>
<td>10</td>
</tr>
<tr>
<td>4.3 The Enumerators and Seminar</td>
<td>12</td>
</tr>
<tr>
<td>PART 5. ORGANISATION OF THE ENUMERATION</td>
<td>12</td>
</tr>
<tr>
<td>5.1 Organisation of Transport</td>
<td>12</td>
</tr>
<tr>
<td>5.2 Supervision of the Enumerators</td>
<td>13</td>
</tr>
<tr>
<td>5.3 Difficulties Encountered in the Enumeration</td>
<td>13</td>
</tr>
<tr>
<td>PART 6. ABSTRACTION AND ANALYSIS OF RESULTS</td>
<td>14</td>
</tr>
<tr>
<td>6.1 Abstraction</td>
<td>14</td>
</tr>
<tr>
<td>6.2 Theory of the Analysis</td>
<td>15</td>
</tr>
<tr>
<td>6.3 Notation</td>
<td>16</td>
</tr>
<tr>
<td>6.4 Formulæ Used in Analysis</td>
<td>16</td>
</tr>
<tr>
<td>PART 7. RESULTS AND DISCUSSION</td>
<td>17</td>
</tr>
<tr>
<td>7.1 Introduction</td>
<td>17</td>
</tr>
<tr>
<td>7.2 The Tables</td>
<td>18</td>
</tr>
<tr>
<td>7.3 Total Acreage, Farm Size and Land Distribution</td>
<td>18</td>
</tr>
<tr>
<td>7.4 Land Tenure System</td>
<td>19</td>
</tr>
<tr>
<td>7.5 Land Use Classification</td>
<td>19</td>
</tr>
<tr>
<td>7.6 Time and Methods of Transport</td>
<td>21</td>
</tr>
</tbody>
</table>
7.7 Regularity of Replanting Cane
22
7.8 The Primary Cultivations and Planting of Cane
23
7.9 Varieties of Cane Grown
24
7.10 Fertiliser Use
25
7.11 Intercropping of Cane
26
7.12 Froghopper Damage and Control of the Pest
26
7.13 Employment of Labour
27
7.14 Estimates of Acreage of Selected Plots
28

PART 8. CONCLUSIONS
28

ACKNOWLEDGMENTS
30

REFERENCES
31

APPENDICES
1.1 General Introduction

A wise agricultural policy, at both farm and governmental levels, depends on having numerous and varied facts available. When these facts are available and the problems enumerated, a policy of research and development can be formulated. In many tropical countries the collection of data on agriculture is extremely difficult due to the lack of trained personnel for the job. A large number of trained personnel would be required to undertake a survey of a large area, and so local agricultural surveys are done in some countries. Where large scale surveys are conducted, such as the World Censuses under the auspices of the United Nations Organisation, the amount of information that can be collected from any one area is necessarily limited. The local organisation of these and similar surveys is usually done by the Department of Agriculture whose officers should have some knowledge of the techniques to be used. This is one of the reasons why post graduate students at the Imperial College of Tropical Agriculture take part in a survey during their course.

In the past, surveys have been done on Land Utilisation (Castle et al, 1955; Buckler et al, 1956) Food Gardens (Currie et al, 1957), Citrus (Alexander et al, 1958) and Bananas (Auckland et al, 1959). In October 1959, at the first meeting of the present survey team, it was decided to conduct a survey of peasant cane farming, and in particular, of those farmers selling cane to Caroni Ltd. Comparatively little detailed information has been collected recently on cane farming, except as part of a general survey of Trinidad agriculture. This information is to be found in Land Utilisation - Agricultural Production (1956). The Soulbury Commission Report (1948) provided a comprehensive review of the sugar industry in Trinidad at that time, but commented on the general lack of information available about cane farmers. A more concise account of the industry is

Before proceeding further with this project, the team gathered background information on sugar cane farming in Trinidad from various sources. Meetings were held with the Executive Committee of the Trinidad Island Wide Cane Farmers' Association and with Mr. Smith, the Cane Farms' Supervisor of Caroni Ltd. These meetings gave the background to the development of the cane industry, the organisation of the cane estates and farmers and elucidated the problems facing the Company and the farmers.

Mr. Smith said that there were approximately 2,400 farmers supplying cane to Caroni Ltd., and their production during the 1959 season had been 172,000 tons of cane. The team was given access to the Company's Cane Farms' Register, which was essentially a list of farmers with contracts to supply cane to Caroni Ltd. Other information available from the Register included the home village of the contract holder, the scale to which cane was delivered and the acreage of cane grown. This Register was to be used as the frame for the survey and its defects will be discussed in Section 3.

1.2 Type of Survey

It was already decided that the project would be a sample survey and not a complete census, but the advantages of the former will be mentioned at this stage.

1. It is less expensive in time, labour and money to do a sample survey than to do a complete census, although the cost per unit is greater in the sample survey. This point is of particular importance in underdeveloped countries with their lack of resources and trained personnel.

2. More detailed information can be obtained from a sample of the population because a greater number of questions can be asked per unit interviewed.
3. The information obtained from a sample is usually more complete because revisits can be made to initial non-responses. These revisits are usually less practicable in complete censuses due to the greater number required.

4. Sampling increases the speed of the field work and of the analysis of the results.

2. THE FRAME AND SAMPLING USED

2.1 The Frame

The Cane Farmers' Register was divided into three sections which corresponded to three distinct areas, and within each section the farmers' names were arranged alphabetically. The numbers of farmers in each area will be found in Appendix I.

The three areas were as follows:

1. The Caroni area, where the farmers grow cane on the flat land of the Caroni River flood-plain between Piarco and Chaguanas.

2. The Esperanze area situated between Chaguanas and Couva, where the land is slightly more undulating.

3. The Bronte area, which is the southern-most of the three, being situated south of the San Fernando - Mayaro road. This land is mainly hilly, being part of the dissected Naparima peneplain.

2.2 Stratification

During the discussions with the Cane Farmers' Association it was suggested that the survey team might compare farmers on their acreage of cane, their system of land tenure and the distance of their cane from the Company's scale. These points were considered to influence the type of farming and the efficiency of the farmer. The team decided to stratify on the acreage of cane farmed and the area in which the farm was situated. This information could be obtained from the
Cane Farmers' Register. The other two suggested methods of stratification were rejected due to lack of information and the impossibility of making clear group distinctions.

Stratification of the units in the population reduces the variability in the individual strata compared with the whole population, and this leads to lower random sampling errors. The latter is also affected by the size of the sample, a larger sample giving a lower sampling error. (Yates, 1953). It had already been decided to stratify the population into three areas and the total number of strata to be used was reckoned to be either 9 or 12. The lower figure was chosen so that there would be a reasonable number of units in each stratum.

The limits of the three acreage groups were determined mainly by the information received from the Cane Farmers' Association. They told the survey team that farms with more than 10 acres of cane could be considered as economic units, while farmers with less than 5 acres of cane have to find outside employment, either full or part time, to augment their income from cane growing. The size strata were then defined as:

1. Farms with less than 5 acres of cane.
2. Farms with 5 acres but less than 10 acres of cane.
3. Farms with 10 or more acres of cane.

2.3 Calculation of the Sampling Fractions

The team decided to use a variable sampling fraction in the different strata in order to increase the efficiency of the survey. A larger proportion of farms in Caroni would be used and so more farms could be enumerated for the same cost, due to the higher travelling costs to the other two areas. The same thing applies when comparing Esperanza and Bronte areas, but here there was a complicating factor. It was thought that the variability in Bronte was greatest of all three areas and so the sampling fraction should be higher. The result was that Esperanza and
Bromte were sampled at the same rate. In the same way, a larger proportion of the biggest size group (over 10 acres of cane) was taken, as each of these farms contributed a greater amount to the total cane production than a small farm.

The overall sampling fraction for the population was determined by the following factors:

1. The number of students available to do the enumeration.
2. The number of days on which the enumerators could work.
3. The number of farms enumerated per day by each student.
4. The funds available for transport.

It was assumed that a minimum of 20 postgraduate students would be available for 3 days each and that they would be able to visit 3 farms per day. These figures were then modified by allowing for a slower rate of work in the Bromte area and for revisits that would have to be made. It was estimated from these considerations that a sample of 120 farms could be enumerated with the time and resources available. It was found later that, due to the special cases found in the sample, and their subsequent removal from both the sample and the population, the actual sample consisted of 110 farms, out of the total population of 2,824. This gave an overall sampling fraction of 1 in 26.

The relative sampling fractions for the three areas and for the three size groups within each area were then determined, taking into account the following factors:

1. The relative costs of transport to the three areas.
2. The expected variability in the areas.
3. The need for more accurate estimates from the larger size groups.

The following table shows the final sampling fractions:
Stratum | Caroni | Esperanza | Bronte
---|---|---|---
Under 5 acres | 1/31 | 1/94 | 1/83
5 but under 10 acres | 1/6 | 1/19 | 1/23
Over 10 acres | 1/3 | 1/4 | 1/4
Total | 1/14 | 1/29 | 1/33

2.4 Drawing the Sample

The sampling used was a systematic selection from the alphabetical lists of each area and each size group in the area. The contract holders were first classified into their acreage groups from each section of the register, and then every q'th unit was selected, where \( \frac{1}{q} \) was the sampling fraction. The first unit in every stratum was selected by choosing a random number between 1 and q. This type of systematic sampling is almost as good as random sampling if certain types of individual units do not appear periodically in the list. The frame used here appeared to be reasonably random and with no suspicion of periodicity.

3. DEFECTS OF THE FRAME AND SPECIAL CASES

3.1 Introduction

The frame is the basis of a sample survey and as such must be as accurate as possible. The nature and accuracy of the frame will affect the form of the survey and the accuracy of the final results obtained from it. There are two types of defects in the frame, which are:-

1. Defects relating to selected sampling units which will be discovered in the course of the survey and which can then be corrected.
2. Inaccurate information on which the stratification is based and this is very difficult to correct.
Yates (1953) groups the defects of a frame under 5 headings and these will be discussed in relation to this survey, together with the special cases that resulted from these defects.

3.2 Inaccurate Frame

The basis of stratification in each area was the cane acreages as shown in the Cane Farms’ Register. These figures were found to be inaccurate in 28 cases out of the 110 in the final sample, to the extent that these contract holders were put in the wrong strata. Another 2 farmers were put in the wrong strata due to faulty abstraction of data from the Register. This inaccuracy in 30 units could not be corrected by putting the farms in their proper strata after their true acreages had been found, because the population as a whole would still be inaccurately stratified in the Register. The sample would then have borne an unknown relationship to the whole population. Restratification of the population is impracticable as it entails visiting all farms so as to obtain their true acreages.

3.3 Incomplete Frame

There was no reason to suspect that the frame was incomplete but this defect would only have been seen from the use of supplementary information. A list of payments made to farmers for cane delivered in 1959 would have given a complete list but this was not available to the team.

3.4 Frame Subject to Duplications

Duplication may be revealed during the course of the survey but this depends on the size of the sample and the extent of duplication. In the sample drawn for this survey, a husband and wife both had contracts but farmed the same land in the same manner. The holding was therefore treated as being under one contract and an estimated number of duplicates was removed from the population. The matter was further complicated by the
two contracts being in different strata and the team arbitrarily decided to adjust the stratum in which the wife's contract appeared.

3.5 Out of Date Frame

The Register had been revised on July 1st 1959 but even so proved out of date in respect of some farms at the time of the survey. Two farmers in the same stratum of the sample could not be included in the final sample because one of them had surrendered his contract and the other had received notice to quit since July 1959. The sampling fraction of this stratum was \( \frac{1}{80} \) and so an estimated 160 units should have been removed from the stratum population, but this seemed a very high figure. Reference was made to the Company's Rent Roll and from that it was found that there were actually only 22 such cases in the particular stratum. After removing 2 from the sample and 22 from the stratum population, the sampling fraction for the stratum was reduced to \( \frac{1}{94} \) and so less accuracy would be expected. 9 other farmers appeared under this category in the remainder of the strata and these were removed from the stratum populations.

3.6 Inadequate Frame

The frame was adequate, though often inaccurate, in identifying the categories used in stratification, but not in identifying certain special cases. A "contractor" class was found which contains landowners who hold contracts but whose land is rented out to tenants growing cane for the contract-holder. One such contractor found in the sample farmed 200 acres under this system. No supplementary information was available to determine the number of these contractors in the population and so this was estimated from the number in the stratum sample and the corresponding raising factor. The estimated numbers in the population were then removed, the sampling fractions remaining the same.
There were also examples of contract holders who had tenants but with their own contracts. There was no need to make adjustments for these because all contract holders in the frame had been sampled. However, the tenanted land was not included with that of the land owner.

A number of farmers, mainly on the borders of the Caroni and Bronte areas were found to deliver cane to two Companies. Presumably these farmers held contracts with both Companies and delivered cane to the scale which opened first at the start of the cutting season. During the cutting season cane would be delivered to whichever scale was more convenient for the farmer at the time, and there would be no specific allocation of cane fields to one Company or the other. No supplementary information was available to the team to see how many farmers did this and so no adjustments could be made. The only estimate that would be affected by this is the estimate of cane delivered to Caroni from the total population, and this would be too high. To estimate this involves using the total cane acreage of all contract holders in the population and the average yield per acre.

A further single farmer in the sample was growing no cane as he had been given notice to quit by his landlord. This was treated as a special case and an equivalent number of farmers were removed from the total population.

3.7 Conclusions on the Frame and Special Cases

The total number of special cases found in the sample was 7, or approximately 8%, and the total number removed from the original population was 97 or about 3%. The difference between these two percentages was due to the use of supplementary information in some instances. The populations, special cases and samples for the various strata will be found in Appendix I.
4. PRELIMINARY ORGANISATION OF THE SURVEY

4.1 Mapping of the Sampled Units

The farms in the sample were located with the help of overseers, provided by Caroni Ltd., who accompanied members of the survey team. As each farm was located, a sketch map of its position in relation to main roads and milestones was made. Before locating the farms in any area, the overseer was given a list of the farms, and from this worked out a route which would reduce the amount of travelling to a minimum.

In many cases, the farmers were at home when the farms were located and then the overseer explained the purpose of the visit, the nature of the survey and the approximate date when the farm would be enumerated. This helped the team by allaying the suspicions of the farmer as to the motives of the survey.

The sketch maps were transferred to the front page of the questionnaires which also contained the farmer's name, address, scale and code number. The plots to be visited by the enumerators were not located and put on the sketch maps, but a series of random numbers were used to select the plot. The method of selection will be found on page 5 of the questionnaire, (Appendix II).

4.2 The Questionnaire

The method of enumeration for this survey could only be by the use of a questionnaire. But in order to give the enumerators experience in measurements and eye estimates in the field it was decided to include some direct observations on selected cane plots. The following estimates and measurements were chosen and were to be confined to one cane plot per farm, selected at random:

1. The size of the selected plot as determined by pacing the area.
2. The distance between the rows of cane.
3. The amount of froghopper damage present, this being classified
into 3 groups.

4. An eye estimate of the yield, again in 3 groups.

Instructions were to be given to the enumerators in a seminar as to how these factors were to be measured and estimated.

Facing the dimensions of the cane plot, and obtaining an estimate of the area from this by calculation in the office, was included so as to check the farmer's estimate of acreage of the plot. Any great differences in width between the rows would show that some farmers were trying to get a higher or lower plant density per acre. Frog hopper damage to cane could not have been classified simply by questioning the farmer and so an eye estimate had to be made. It has been estimated (Caribbean Commission Crop Inquiry Series No. 6, 1947) that in severe cases of frog hopper damage, the yield of cane may be reduced by up to 9 tons per acre. The degree of damage is therefore of great importance. Eye estimates of yield were recorded in order to obtain some idea of the productivity of the cane farming.

The questionnaire consisted of three groups of questions, a section on eye estimates which has just been discussed, instructions for the enumerators and a top sheet giving details of the farm. A complete questionnaire will be found in Appendix II.

The three groups of questions were as follows:-

1. Questions relating to all plots of land farmed by the contract holder.

2. Questions on the techniques of planting cane in 1959.

3. Questions relating to the farm as a whole.

When the form of the questionnaire was finalised the members of the survey team each enumerated one farm to find out whether any alterations would be necessary in the form, content or wording of the questionnaire. Only minor changes were made to the draft form as a result of this enumeration.
4.3 The Enumerators and Seminar

The enumerators used in this survey were the majority of the post graduate students of the Imperial College of Tropical Agriculture. Due to many of them having made previous arrangements for the Christmas vacation, they were given the choice of working either before Christmas or in the New Year. About two thirds of those available elected to work before Christmas.

Towards the end of the first term, a seminar under the chairmanship of Dr. Jolly was held for all students taking part in the survey. The purpose of this was to give the enumerators a background to this survey, and of sample surveys in general, and to elaborate on the questions and instructions contained in the questionnaire. The organisation of transport for the survey was also dealt with at this stage. Following the seminar there was a demonstration at the College Old Farm of the eye estimates of field and froghopper damage. The pace of each enumerator was calibrated so that measurements in the field could be recorded in paces and subsequently converted to yards and acres.

5. ORGANISATION OF THE ENUMERATORS

5.1 Organisation of Transport

In view of the restricted mileage that could be travelled it was necessary to fill all cars used in the enumeration, if this was possible. Two types of transport arrangement had to be used, depending on the area. In the Caroni and Esperanza areas it was generally possible to find groups of two to four holdings within reasonable walking distance. In these areas each enumerator was taken to his first allotted holding by the driver of the car. The driver then enumerated his own holdings before returning to pick up the other enumerators at pre-determined points. This system generally worked satisfactorily and the enumerators were not required to wait around for too long, provided that all the farmers were at home and available for questioning.
In the Bronte area, with its low sampling fraction and scattered holdings, each enumerator was given one farm to do before being picked up and transported to the next farm.

5.2 Supervision of the Enumerators

At least 24 hours notice was given to enumerators of the days on which they would be required. Packed lunches were obtained and these, together with questionnaires, were issued by members of the team each morning. The drivers of all cars were given master maps of the area to be covered, with all set-down and pick-up points marked on them.

There was no supervision of the enumerators in the field by members of the survey team. This was not considered necessary after the team's experience of enumeration with the test questionnaire. This enumeration had easily been done and the team had confidence in the enumerators being able to do the work after attending the seminar and demonstration.

On the return of the enumerators all questionnaires were collected and checked by members of the team. This checking was done immediately so that the facts concerning any query would be fresh in the mind of the enumerator. The drivers of all cars were also required to state the mileage travelled in the day. Approved claims for mileage allowances were then made by the individual drivers.

5.3 Difficulties Encountered in the Enumeration.

The main difficulty encountered was the natural suspicion of the Trinidad farmer when faced with a stranger asking questions about his farm. There was a tendency on the part of some farmers to treat the enumerators as Government snoopers and to give them wrong information. In many areas this suspicion was not encountered because the Company had informed the farmers that the survey would be conducted by Imperial College students.
One farmer was not initially located when the team were preparing sketch maps because the overseer provided by the Company did not cover the area concerned.

Much difficulty was encountered in trying to estimate the acreage of the selected plots. The main difficulties were:

1. Irregular shape of the fields.
2. Boundaries situated along stream banks.
3. Indistinct boundaries between one cane plot and another.

Of the 106 farms visited and enumerated only 75 had their sampled plots measured. On 5 of the plots, the acreage given by the farmer, and that estimated from the enumerators' paces differed by more than 30%. This discrepancy was probably due to the enumerators not using the random numbers table properly and not to inaccuracies in pacing.

6. ABSTRACTION AND ANALYSIS OF RESULTS

6.1 Abstraction

When all the enumeration was complete it was necessary to abstract the information required from the questionnaire in order to facilitate the computation of results. It was realised that the transfer of data from one sheet to another involved the risk of copying errors but cross checking was done wherever possible on the abstraction sheets. A complete stratum was abstracted by one member of the team and then was checked by a different member of the team.

The number of sheets that had to be handled was reduced from 220 in the original questionnaires to 54 abstraction sheets. The acreage figures on abstraction were corrected to one decimal place as were the raising factors, the stratum raised totals being taken to two decimal places. These totals were then used by Roche in his preliminary report on the survey.
6.2 Theory of Analysis

The aims of the analysis of the information collected can be classified under the following headings:

1. With quantitative variates such as the acreage of cane grown in each stratum.
   (a) The estimation of stratum population means and totals, where the stratum population is the total number of contract holders in that area and size group minus the defined number of special cases.
   (b) The estimation of the standard errors of the strata.
   (c) The estimation of the district population totals, the size group population totals and survey population totals by the addition of estimated stratum population totals.
   (d) The estimation of the district population means, the size group population means and survey population means by the division of the sum of the estimated stratum population means.
   (e) The estimation of standard errors of districts, size groups and the survey from the sum of the estimated variances of the strata.

2. With qualitative variates such as the number of farmers using phosphatic or potassic fertilisers.
   (a) The estimation of stratum population totals and proportions.
   (b) The estimation of.
   (c) The estimation of population totals, proportions and errors for districts, size groups and the survey, by methods used in 1(c) and 1(d) of this section.

3. Comparisons of the enumerators' and farmers' estimates of the selected cane plots. The difference between the two estimates would be expressed as a percentage of the farmers' estimate.

NOTE Although a two stage sample was used in that part of the survey dealing with direct observations and measurements it was not possible to obtain estimates of within farm variation because only one plot was sampled on each farm. Thus all data in the analysis has been treated as if it was from a single stage sample.
6.3 Notation

The notation used is that used in Yates (1953). A super-bar denotes a mean value. A single sub-bar denotes an estimated value and a double sub-bar denotes a true value.

The notation is as follows:

\[ f = \text{sampling fraction} \]
\[ g = \text{raising factor} \]

suffix \( i \) denotes a value belonging to a particular stratum.

\[ n = \text{number of units in the stratum} \]
\[ N_i, N = \text{number of units in the population and its estimate} \]
\[ p = \text{proportion of units in sample with a given attribute} \]
\[ q = 1 - p \]
\[ s^2 = \text{estimate of variance of any given variate} \]
\[ S = \text{summation of values} \]
\[ S.S. = \text{sum of squares} \]
\[ S.E. = \text{estimated standard error} \]
\[ u = \text{number of units in the sample with a given attribute} \]
\[ U_i, U = \text{number of units in the population with a given attribute and its estimate} \]

\[ 
\begin{align*}
V & = \text{estimated variance of any variate} \\
\bar{Y} & = \text{estimated mean of a quantitative variate} \\
\bar{Y} & = \text{estimate of population value for a quantitative variate} 
\end{align*}
\]

6.4 Formulae Used in Analysis

1. Formulae for quantitative variates

a. Stratum totals and means.

\[ N = gn \]
\[ \bar{Y} = \frac{S(Y)}{n} \]
\[ \bar{Y} = \frac{N \bar{Y}}{n} \]
b. Standard errors of totals.

\[ V(\bar{Y}) = n s^2 g (g - 1) \]


\[ V(\bar{y}) = \frac{1}{n} \left( \frac{1}{g} \right) \]

Hence S.E. \( \bar{y} = s \sqrt{\frac{1-f}{u}} \)

2. Formulae for qualitative variates.

For a qualitative variate \( y = 1 \) if the sampling unit has the given attribute and \( y = 0 \) if the attribute is absent.

Therefore \( \bar{y} = \frac{u}{n} = p \)


\[ V(\bar{y}) = \frac{1}{n} \left( \frac{1}{g} - \left( \frac{s(y^2 - (\bar{y})^2)}{n} \right) \right) \frac{1}{n-1} (1 - f) \]

\[ V(p) = \frac{B(1-p)}{n-1} (1 - f) \]

\[ V(u) = \frac{g(u-1)}{n-1} u (n-u) \]

7. RESULTS AND DISCUSSIONS

7.1 Introduction

The usefulness of a sample survey depends on the use to which the collected information can be put. The accuracy of the information will to some extent determine how the results can be used. In this particular survey a wide range of standard errors was found, dependant on the variability in the strata. The standard errors of the totals of the three main statistics were reasonably low (between 7 and 13%) although for individual strata the range was from 8% to 31%. The three main statistics were total acreage of land, total cane acreage and total of 1959 planted cane in the survey. The high standard errors for individual strata (up to 97% in one table) were partly explained by the variability due to misplacement of farms in the wrong size groups and partly because of low sampling fractions in some strata. The standard errors of the strata were not particularly important as the team did not set out to compare
individual strata but rather to compare areas and size groups.

7.2 The Tables

The information obtained from this survey will be found in Volume II of the survey report. The figures are generally given to the nearest unit because greater accuracy than this could not be claimed in the survey. In the text of the report, tables will usually have acreage figures to the nearest 10 acres and other figures to the nearest whole number. These text tables will be abstractions from the complete tables.

7.3 Total Acreage, Farm Size and Land Distribution

It was estimated that the population surveyed numbered 2,824 farmers and that they farmed 19,210 acres giving an average of about 6.8 acres per holding. The following table shows the average size of holdings in the various strata which is not to be confused with the average acreage of cane, which can be compared with the stratification groupings.

<table>
<thead>
<tr>
<th>Stratum</th>
<th>Caroni</th>
<th>Esperanza</th>
<th>Bronte</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 5 acres</td>
<td>7.0</td>
<td>3.8</td>
<td>5.3</td>
<td>5.0</td>
</tr>
<tr>
<td>5 and less than 10 acres</td>
<td>8.5</td>
<td>8.5</td>
<td>10.0</td>
<td>9.0</td>
</tr>
<tr>
<td>More than 10 acres</td>
<td>22.5</td>
<td>19.0</td>
<td>37.0</td>
<td>26.0</td>
</tr>
<tr>
<td>Mean</td>
<td>8.4</td>
<td>5.3</td>
<td>7.7</td>
<td>6.8</td>
</tr>
</tbody>
</table>

From this table it appears that the farms in the Esperanza area are considerably smaller on average than the farms in the other two areas. This is due to the greater proportion of small farmers and lower proportion of large farmers in the Esperanza area, rather than to differences in the proportions of land in the strata (Table 24). The Bronte area has the
smallest proportion of large farms of the three areas but their average size is very much the greatest. This would be accounted for by the lower population density in the area compared with Caroni and Esperanza areas.

7.4 Land Tenure System

Table 3 shows that about half the total acreage surveyed was held freehold, but there was great variation between size-groups and between the different areas. The Caroni area has a uniformly high proportion of freehold land in all size-groups, but in the other two areas there was virtually no freehold land in the 5 to 10 acre size group, but yet the largest size group (over 10 acres) had about 60% freehold land. There seems to be no explanation for this state of affairs.

As far as could be ascertained during the survey and from information obtained from outside sources, the 52% of tenanted land was usually held on annual tenancies for which there was no written agreement. The tenants of the Company are gradually being given written agreements but this process is still in its early stages. Land rents are restricted by Government Ordinance but this does not prevent farmers paying private landlords up to 3 times the legal maximum rent so that they can increase the size of their holdings. This has the effect of squeezing out the poorer farmer and increasing the area farmed by the larger farmers. On the question of tenancy agreements, the Ward Committee Report (1958) suggested the use of 5 year leases but so far this has not been implemented to any great extent.

7.5 Land Use Classification

Almost 80% of the total acreage in the survey was estimated to be under sugar cane (Table 6) with the proportions varying from 71% in the Bronte area to 89% in the Esperanza area. The variation between size groups was less than this, with the under 5 acre group having the lowest percentage of land in cane.
The following table shows the average acreage of cane per farm for the 9 strata, together with the standard errors.

**Mean acreage of cane per farm, in acres.**

<table>
<thead>
<tr>
<th>Stratum</th>
<th>Caroni</th>
<th>Esperanza</th>
<th>Bronte</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 5 acres</td>
<td>5.3 ±1.1</td>
<td>3.4 ±0.0</td>
<td>3.4 ±0.0</td>
</tr>
<tr>
<td>5 and less than 10 acres</td>
<td>6.4 ±0.1</td>
<td>7.5 ±1.1</td>
<td>8.1 ±1.6</td>
</tr>
<tr>
<td>More than 10 acres</td>
<td>17.4 ±1.8</td>
<td>16.1 ±5.4</td>
<td>29.7 ±7.7</td>
</tr>
</tbody>
</table>

The frame was stratified on acreage of cane and so the above figures show how the inaccuracies in the frame were distributed. Only in the case of one stratum was the mean acreage of cane outside the stratum limits, and the standard error of the mean was high due to the great variability in the individual cane acreages.

According to the Cane Farmers' Association, those farms with less than 5 acres of cane are uneconomic units. In this survey about \( \frac{2}{3} \) of the farms would be considered uneconomic if our under 5 acre group is used, but this will give a high estimate due to the number of farmers wrongly put in this size group.

Although this is not an economic survey, one can get some idea of the incomes of these small peasant farmers. The total acreage of the under 5 acre group averages 5 acres of which 76% is under cane (Table 6). Assuming that the yield per acre of cane is 11 tons and that the farmers are paid \$12 per ton of cane delivered, the gross income from cane would be about \$500. This is possibly a conservative estimate as the Soulbury Commission Report (1948) gives a yield of 9.6 tons per acre of cane and there may not have been an increase in yield from farmers' cane since then. To get nearer to the small farmers' true income, one must deduct the cost of hired labour and of fertilisers. The table in section 7.13 shows that \( \frac{3}{4} \) of the farmers in the under 5 acre size group employ more than \$50 worth of labour per year and Table 34 gives the fertiliser use as 1 bag of sulphate of ammonia.
per acre of the farm. The latter is at present valued at about $10 per bag and so fertiliser expenditure is on average $50 per farm. The majority of the farmers in the small size group will therefore have an income of about $400 per year from cane, but 92% of them augment this with work off the farm which is valued at $50 or more per year. This confirms the statement from the Cane Farmers’ Association that most of the farmers with less than 5 acres of cane have to take outside employment. The numbers of farmers in other strata who earn more than $50 per year in off-the-farm employment will be found in Table 37.

The major crop, other than cane, was found to be rice which accounted for an estimated 1,190 acres or 6% of the total land (Table 9). Over half of the rice was grown in the flat, low-lying Caroni area with the greatest proportion being in the under 5 acre size group.

When one considers the total estimated acreage of cane and its distribution in the strata, the farmers in the smallest size group are seen to farm over half the total cane acreage. The breakdown into strata is as follows:

<table>
<thead>
<tr>
<th>% Total cane acreage found in each stratum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stratum</td>
</tr>
<tr>
<td>Less than 5 acres</td>
</tr>
<tr>
<td>5 and less than 10 acres</td>
</tr>
<tr>
<td>More than 10 acres</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

7.6 Time and Methods of Transport

The times of travelling to and from the cane fields during cultivations, and to the scale during the cutting season were considered to affect the efficiency of cane farming. From Table 55, it appears that about 20% of the total land under cane was more than one hour’s journey from
the homestead. Thus the working day was shortened by two hours due to travelling time and this does not encourage the West Indian farmer to visit his cane too often.

Table 56 shows that it takes 2 hours to reach the scale from cane fields occupying 15% of the cane acreage. This will severely limit the number of loads that can be taken off these fields each day. In the Caroni area, Mr. Smith said that scales were situated at distances no greater than 4 miles apart, and so farmers should not have to cart cane more than 2 miles. Assuming that bullocks travel at 2 m.p.h. then 15% of the cane in Caroni would be more than 4 miles from a scale. This seems to suggest that some of the farmers may have misunderstood the enumerators and included time waiting at the scale in their answers.

There is a greater use of mechanised transport in the Caroni area compared with the other two areas (Table 57), this probably being due to the better roads and traces of the area.

In the Esperanza area there is a greater tendency for farmers to hire bullocks and mules for carting cane when compared with the other two areas. This may be explained by the smaller average size of holding in the area which does not allow animals to be kept.

Throughout the whole survey area, it was roughly estimated that 1 bullock carted the cane from between 4 and 6 acres. These figures however are not reliable, as the questionnaire only differentiated between those farmers using animal transport and those not. To get an accurate estimate one would also have to find out the numbers of animals used by each farmer.

7.7 Regularity of Replanting Cane

Information from several sources suggested that part of the blame for the low yields of peasant cane rested on infrequent replanting and consequently cane being left to ratoon for too many years. This situation was not generally found and Table 52 shows that about 93% of all cane was
planted in or since 1955. From this figure it would seem that the cane farmers replant their cane about every four or five years which is very little different from the rate of replanting used on the estates.

In some years, notably 1958 in the Esperanza area and 1959 in the Caroni area, there was a great increase in the amount of cane replanted when compared with previous years. Although no explanation for this was given by the farmers, it was probably due to favourable weather conditions at the time when planting is usually done. About half the cane is planted in the wet season of June to September and when this period is drier than average the land is more easily worked especially in the Caroni area. Table 26 shows the months of planting cane and in the Caroni area there is only about 5% of the total cane planted from October to December, this being due to the farmers not being able to work their type of soil when it is too wet at the end of the rainy season. This problem is less severe in the other two areas and in Bronte, the cane is planted throughout the year.

7.8 The Primary Cultivations and Planting of Cane

As with cane transport, there was more mechanisation in the Caroni area than in the other two areas when methods of cultivation were examined. It was estimated that almost all the cane land was cultivated by machine in the Caroni area (98%) compared with 86% and 42% in the Esperanza and Bronte areas respectively. The low figure for Bronte is undoubtedly due to the hilly nature of the terrain. Table 26 also shows that there is virtually no ploughing with oxen; only one farmer in the sample was found to do this.

The figures in the following table show that a large proportion of the land replanted in cane in 1959 was drained or put into beds.
% of 1959 planted cane acreage that was drained

<table>
<thead>
<tr>
<th>Stratum</th>
<th>Caroni</th>
<th>Esperanza</th>
<th>Bronte</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 5 acres</td>
<td>88</td>
<td>51</td>
<td>88</td>
<td>75</td>
</tr>
<tr>
<td>5 and less than 10 acres</td>
<td>96</td>
<td>59</td>
<td>100</td>
<td>85</td>
</tr>
<tr>
<td>More than 10 acres</td>
<td>100</td>
<td>79</td>
<td>83</td>
<td>88</td>
</tr>
</tbody>
</table>

From these figures, the indication is that more of the cane land is drained with an increasing cane acreage. The explanation for this is probably that the larger farmer can better afford to have his land drained while the small farmer cannot spare the time or afford the money to pay for the work to be done. In the Esperanza area there appears to be a greater reliance on natural drainage.

The acreages of cane that are planted in beds is shown in Table 27. From this table great differences are once again seen between the different areas. In the Caroni area most of the cane is planted on beds but in Bronte the majority of cane is not planted on beds at all. Of the cane that was planted on beds almost all was put in rows along the length of the beds and very little across the beds.

It was estimated that in the Esperanza and Bronte areas 4% and 12% respectively of the farmers who had hilly land practised any form of soil conservation. However, the farmers' ideas on conservation did not always agree with those of the team. One farmer enumerated by the writer said that he practised soil conservation by putting his rows of cane up and down the field so that the water could run away. The reliability of these figures is therefore doubtful.

7.9 Varieties of Cane Grown

The newer varieties of cane bred in Barbados are now used almost exclusively on the estates as they considerably out-yield the older varieties. On the cane farms there is no means of buying setts of these
new varieties, as neither the estates nor the Government sell planting material. This absence of new varieties was considered to be one of the reasons for the low yield from farmers' cane and so the farmers were asked what varieties of cane they planted. Table 39 shows that about 40% of the cane acreage was planted to known modern Barbados varieties and about 20% to known old varieties. The remaining cane acreage was planted with cane of unknown variety.

It was found that the main way in which farmers got planting material of modern varieties was to cut it from the estate cane fields. This would explain the high proportion of unknown cane because the farmer does not always know what variety he is cutting from the cane estate.

7.10 Fertiliser Use

The most commonly used fertiliser on cane lands is sulphate of ammonia, which was formerly supplied by the Company at the rate of 1 bag for every 10 tons of cane delivered by the farmer. The cost of this fertiliser was then deducted from the final payment at the end of the cane season. In the last few years this service has been gradually taken over by the Cane Farmers' Association with the aid of loans from the Territorial Government. This change-over has resulted in a decrease in the price of fertilisers.

In the Caroni area it was estimated that all the cane land received sulphate of ammonia (Table 30) while in Esperanza and Bronte the proportions were just over 60% and 80% respectively. Pen manure was used to only a limited extent and this is probably because of the high cost of transporting it to the cane fields. An estimated 31 farmers in the population used phosphatic and potassic manures. This is more or less in line with estate practice, following experiments which showed that there were no significant increases in yields on many Trinidad soils by the application of phosphate or potash.
7.11 *Intercropping of Cane*

The intercropping of newly planted cane with food crops has apparent advantages to the farmer, but the disadvantages may not be so apparent. In intercropped cane it is possible to get some return from the land in the form of food during the time to the first harvest which may be as long as 18 months. The competition between cane and food plants will be quite great and the yield of cane may be adversely affected due to lack of nutrients and water. The following table shows the percentage of farmers in each stratum who intercropped part or the whole of the cane they planted in 1959.

<table>
<thead>
<tr>
<th>Stratum</th>
<th>Caroni</th>
<th>Esperanza</th>
<th>Bronte</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 5 acres</td>
<td>54</td>
<td>88</td>
<td>67</td>
<td>63</td>
</tr>
<tr>
<td>5 and less than 10 acres</td>
<td>50</td>
<td>100</td>
<td>83</td>
<td>65</td>
</tr>
<tr>
<td>More than 10 acres</td>
<td>43</td>
<td>55</td>
<td>50</td>
<td>48</td>
</tr>
<tr>
<td>Total</td>
<td>49</td>
<td>76</td>
<td>59</td>
<td>58</td>
</tr>
</tbody>
</table>

From this table it appears that the Esperanza farmers are trying to increase their effective farm size by a greater amount of intercropping. In the other two areas there is less intercropping, but the average farm size is greater and there is also a bigger acreage of pure-stand food crops grown (see Land Use Classification, Table 5).

7.12 *Froghopper Damage and Control of the Pest*

The damage to cane, caused by froghopper, was determined by eye estimate on the randomly selected cane plot of each farm. The severity of damage increased markedly from the south of the survey area to the north. There was no severe damage in the Bronte area while the estimated proportions in Esperanza and Caroni were 16% and 20% respectively. The proportions of cane free from damage generally showed a decrease from Bronte to Caroni,
although the latter area had a higher proportion of cane free of damage than might be expected. This is accounted for by the high percentage of plant cane which is rarely attacked by froghopper. These figures (Table 47) can be compared with those for froghopper control (Table 49). There is an increased proportion of cane treated for froghopper control going from Bronte northwards to Caroni, but also increasing damage. This indicates a much greater infection with froghopper in Caroni and possibly the ineffectiveness of the control measures.

The main method of control is by dusting the cane stools and surrounding soil with B.H.C. dust in order to kill the nymphs. This may be ineffective due to bad timing of the application of the dust. On the estates this method is used in conjunction with drift dusting which controls the adults in the cane foliage.

7.13 Employment of Labour

The following table, which gives the percentage of farmers in each stratum who hire more than $50 worth of labour per year shows the expected tendency that more of the larger farmers hire labour compared with the under 5 acre group. In the Caroni and Esperanza areas proportionately more farmers hire labour than in the Bronte area, this possible being due to the greater prosperity of these two areas as has been seen before in this report.

<table>
<thead>
<tr>
<th>Stratum</th>
<th>Caroni</th>
<th>Esperanza</th>
<th>Bronte</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 5 acres</td>
<td>79</td>
<td>80</td>
<td>67</td>
<td>75</td>
</tr>
<tr>
<td>5 and less than 10 acres</td>
<td>95</td>
<td>89</td>
<td>86</td>
<td>90</td>
</tr>
<tr>
<td>More than 10 acres</td>
<td>93</td>
<td>100</td>
<td>100</td>
<td>98</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>83</td>
<td>82</td>
<td>71</td>
<td>79</td>
</tr>
</tbody>
</table>

Table 37 shows that a large proportion of the cane farmers have outside employment; most of this in the Caroni and Bronte areas is on the
sugar estates or working for other farmers. The standard used was again £50 per year which is roughly equivalent to 2 weeks full time employment. The figures for the three areas follow the same trend as in the above table for the hiring of labour. A greater proportion of the Caroni farmers go out to work for other employers and they also employ more labour. This could be regarded as cause and effect. The reverse is true in the Bronte area, which has the smallest proportions of farmers going out to work elsewhere and hiring labour.

7.14 Estimates of Acreage of Selected Plots

Mention has been made in section 53 of the difficulties involved in measuring the sampled plots and so only 70 farms in the sample were used to obtain an estimate of acreages. When the farmers' estimates and the enumerators' estimates for the total acreage were compared, the latter exceeded the farmers' estimates by about 7%. As this figure is within the range, one would expect in this type of estimation (say, 10% either way) it was considered that the farmers' estimates were approximately accurate.

8. CONCLUSIONS

From this survey it seems that about 75% of the farmers in the population have too little cane land (less than 5 acres) to make a reasonable living solely from cane farming. Moreover, these holdings are usually fragmented and the various parcels of land scattered over a considerable area.

In addition to not having sufficient land, the majority of farmers also get low yields of cane per acre. The reasons for this are mainly as follows:

1. Cultivation of the land is not deep enough despite the use of mechanised equipment, as this is usually of the light wheeled tractor type. The use of mechanised cultivating equipment is more prevalent in the Caroni
and Esperanza areas due to the less hilly topography.

2. The rate of fertiliser application is low compared with the estates and may do little to increase yields.

3. 40% of the cane acreage was known to be planted with modern varieties of cane but these have little chance to show their potential worth due to other limiting factors.

4. Froghopper damage, which was particularly severe in the Caroni area, also helps to keep down cane yields.

Because of the small size of farms and low yields, most farmers are not occupied for the whole year and have a low cash income from cane and so must take employment off the farm. On the other hand, in periods of peak labour demand, such as the cutting season, they have to employ labour.
ACKNOWLEDGMENTS

I would like to express my thanks to the following for help given during the Survey:

Dr. A.L. Jolly, Economics Department, I.C.T.A. Supervisor.

Mr. G.E. Hodnett, Regional Research Centre. Statistician.

Mr. Smith, Cane Farmers' Supervisor, Caroni Ltd.

The Executive Committee of the Trinidad Island Wide Cane Farmers' Association.

The student enumerators.

Mr. R.A. Bohun, team statistician.

The other members of the survey team.
REFERENCES

Alexander, J.I.; Amazigo, E.O.; Barrie, J.W.; Mc Clean, H.A.M.; York, K.G. (1958)
A Sample Survey of Citrus

Auckland, J.N.; Bird, J.R.; Deness, A.; Farley, A.; (1959)
A Sample Survey in Bananas in Trinidad.

An Experimental Land Utilisation Sample Survey


An Experimental Land Utilisation Sample Survey

A Survey of Food Gardens in Three Counties of Trinidad.


## APPENDIX I

Data on Population Totals, Special Cases and Non Responses in the Strata.

<table>
<thead>
<tr>
<th>Stratum</th>
<th>Original sample</th>
<th>Special cases in original sample</th>
<th>Final stratum total</th>
<th>Final sample</th>
<th>Final f</th>
<th>Non responses in sample</th>
<th>Original g</th>
<th>Final g</th>
</tr>
</thead>
<tbody>
<tr>
<td>C 1</td>
<td>506</td>
<td>16</td>
<td>32</td>
<td>4,74</td>
<td>15</td>
<td>1/31</td>
<td>31.6</td>
<td>33.9</td>
</tr>
<tr>
<td>C 2</td>
<td>157</td>
<td>19</td>
<td>8</td>
<td>149</td>
<td>18</td>
<td>1/8</td>
<td>8.2</td>
<td>8.3</td>
</tr>
<tr>
<td>C 3</td>
<td>51</td>
<td>17</td>
<td>6</td>
<td>45</td>
<td>15</td>
<td>1/3</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Total</td>
<td>714</td>
<td>52</td>
<td>46</td>
<td>668</td>
<td>48</td>
<td>1/14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E 1</td>
<td>965</td>
<td>12</td>
<td>22</td>
<td>943</td>
<td>10</td>
<td>1/94</td>
<td>78.5</td>
<td>94.3</td>
</tr>
<tr>
<td>E 2</td>
<td>201</td>
<td>10</td>
<td>5</td>
<td>196</td>
<td>10</td>
<td>1/19</td>
<td>not used</td>
<td>21.8</td>
</tr>
<tr>
<td>E 3</td>
<td>54</td>
<td>13</td>
<td>0</td>
<td>54</td>
<td>13</td>
<td>1/4</td>
<td>not used</td>
<td>4.2</td>
</tr>
<tr>
<td>Total</td>
<td>1,220</td>
<td>35</td>
<td>27</td>
<td>1,193</td>
<td>33</td>
<td>1/29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B 1</td>
<td>757</td>
<td>9</td>
<td>2</td>
<td>755</td>
<td>9</td>
<td>1/83</td>
<td>not used</td>
<td>83.9</td>
</tr>
<tr>
<td>B 2</td>
<td>182</td>
<td>9</td>
<td>21</td>
<td>161</td>
<td>8</td>
<td>1/23</td>
<td>20.2</td>
<td>23.0</td>
</tr>
<tr>
<td>B 3</td>
<td>48</td>
<td>12</td>
<td>1</td>
<td>47</td>
<td>12</td>
<td>1/4</td>
<td>not used</td>
<td>4.3</td>
</tr>
<tr>
<td>Total</td>
<td>987</td>
<td>30</td>
<td>24</td>
<td>963</td>
<td>29</td>
<td>1/33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Survey Total</td>
<td>2,921</td>
<td>117</td>
<td>77</td>
<td>2,324</td>
<td>110</td>
<td>1/26</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Survey Total: 2,921
A. (1) Serial No. C/R27
(2) Name. Rampal Karew
(3) Address. Caroni Village
(4) Scale. Mon Jaloux
(5) Acreage of cane in Field Register. 8.5
(6) Directions to reach Holding.

To Piarco

R27

From Churchill Roosevelt Highway

Proceed along Old Southern Main Road and turn left at the 4½ mile post, then first turning on the right and second on the left. R 27 is the first farm on the left.
### Number of blocks and crops growing on them

<table>
<thead>
<tr>
<th>Block</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Acreage (acres and roods)</td>
<td>6.0</td>
<td>4.2</td>
</tr>
<tr>
<td>2. Ownership (T &amp; F)</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>3. Distance from: Homestead</td>
<td>100</td>
<td>120</td>
</tr>
<tr>
<td>Scale</td>
<td>120</td>
<td>180</td>
</tr>
</tbody>
</table>

### Plot

<table>
<thead>
<tr>
<th>Plot</th>
<th>A, A, A, A, B, B, B, B</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Acreage C</td>
<td>2', 2', 1', 1', 1', 1', 1', 1'</td>
</tr>
<tr>
<td>5. Fertiliser applied last year (O, N, P, K, M)</td>
<td>NK, NK, NK, NK, NK, NK, NK</td>
</tr>
<tr>
<td>6. Froghopper control (O, D, C)</td>
<td>DC, DC, DC, DC, DC, DC</td>
</tr>
</tbody>
</table>

### Last planted cane plot

<table>
<thead>
<tr>
<th>A1</th>
<th>B2</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

### Whole Farm

<table>
<thead>
<tr>
<th></th>
<th>S/A</th>
<th>P</th>
<th>K</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15</td>
<td>-</td>
<td>5</td>
<td>10</td>
</tr>
</tbody>
</table>

#### Transport

<table>
<thead>
<tr>
<th>Tractor</th>
<th>Truck</th>
<th>Large Animal</th>
<th>Donkey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owned</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hired</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hired out</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Work off the farm in excess of $50 per annum

<table>
<thead>
<tr>
<th>Cane estate</th>
<th>Other cane farmers</th>
<th>Other crop farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

#### Hired labour more than $50 per annum

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>
Measurements

1. Size of plot | 120 x 800
2. (a) Planting across or along beds (A or X)  
   (b) Distance between rows.
3. Froghopper damage (O, M, S.)
4. Estimated tonnage (10, 10-25, 25)
5. Plot hilly (Yes/No.)  
   No
6. Soil conservation measures if hilly (Yes/No.)

7. Notes:
   Plot 8, was some dam to rice but failed
   due to shortage of water

Cane plot selections (selected plot ringed 

\[ \begin{array}{cccc}
2 & 1 & & \\
3 & & 2 & 1 \\
4 & 3 & 2 & 1 \\
5 & 4 & 3 & 2 & 1 \\
6 & 5 & 4 & 3 & 2 & 1 \\
7 & 6 & 5 & 4 & 3 & 2 & 1 \\
8 & 7 & 6 & 5 & 4 & 3 & 2 & 1 \\
9 & 8 & 7 & 6 & 5 & 4 & 3 & 2 & 1 \\
10 & 9 & 8 & 7 & 6 & 5 & 4 & 3 & 2 & 1 \\
11 & 10 & 9 & 8 & 7 & 6 & 5 & 4 & 3 & 2 & 1 \\
12 & 11 & 10 & 9 & 8 & 7 & 6 & 5 & 4 & 3 & 2 & 1 \\
\end{array} \]
Blocks of land to be distinct units either geographically or as regards tenure. Each block should be denoted by a letter progressing in alphabetical order. Start with one block and on completing Section I move straight into Section II breaking the block up into component plots before proceeding to a second block.

A plot of land is any area with a distinct crop on it or cane of a distinct age. Plots should be denoted by the relevant block letter followed by a suffix number i.e. A1, A2, etc. If there are more than eleven plots use an additional sheet 2.

(1) Acreage as given by the farmer. At the end ask the total acreage and then check that this agrees with total of individual plots. All land owned or leased by the contracting farmer should be included whether actually farmed by him or not.

(2) Ownership as stated by the farmer. If possible see tenancy agreement and indicate its presence with T, otherwise t.

Freehold - F.

(3) Distance from homestead and scale to be expressed in time in minutes taken using usual method of transport.

(1) Crop. Whether cane (C), food crops (F), rice (R) other crops (O), and uncultivated land (U). Where a block is in more than one crop each separate plot should be recorded in a separate column as explained above.

(2) Acreage of plot. Where a plot is in cane the farmer's estimate of acreage should be recorded. Either farmer's estimate of each crop.

(3) Year and month of planting. (This and following questions apply only to sugar cane. Leave plot columns referring to other crops blank.)

(4) Variety. Distinguish between modern (M) with identification numbers of more than four digits, e.g. 37161, and old (O) varieties and "don't know (X).

(5) Fertiliser. Whether applied or not. If not insert 0, and if applied state N, P, K, or pen manure (M).

(6) Frog hopper control. Ask what method used to control frog hopper. Do not ask whether a particular practice was adopted for frog hopper control. Indicate whether dusted (D), cultivation (C) or both or none at all (O).

Questions in this section are to be confirmed to all plots planted in 1959. If none planted in 1959 then the most recently planted plot should be used. If two or more plots occur in a year other than 1959 only the most recent should be recorded e.g. if May and July, 1958 record July, 1958 only. The date of planting is shown in Section E, Part II, question 2. "With the 1959 plant crop enter the earliest planted in the first column and that planted on successive dates in following columns in chronological order.

(1) Initial cultivation. Whether using hand (H), animal (A) or mechanical (M) draught power.

(2) Drainage. Whether drains actually constructed or not.

(3) Planting done using fork (F), pick (P), plough (P1), or crowbar (C).

(4) Intercropping.
Weedings. Distinguish between separate weedings and a single weeding spread over a period of time interrupted at intervals. Note number of weedings or whether continuous (C).

D. (1) Record number of bags of fertilisers or cartload (pen manure). Where less than 1 bag used record the pounds weight and take 1 truck load to 3 cart loads (of pen manure).

(2) Transport. Large animal include water buffalo, oxen, mules and horses.

E. (1) The plot to be examined is selected from the numbers at the bottom of sheet 3. For instance if 6 cane plots have been recorded and the number 3 is ringed in the line of numbers referring to 6 plots the plot reported in the third cane column of data on page 2 para. II is to be examined. With the farmers' assistance, visit this plot and fill in page 3.

Size of plot to be paced out in normal paces which have previously been calibrated in feet. Two adjacent sides to be paced taking as far as possible the longest and straightest sides.

Draw a diagram if the plot is not rectangular.

(3) Froghopper damage. To be made by visual observation. No scarring of leaf (O), scarring of leaves (M), dead cane, dead terminal leaves (S).

(4) Estimated tonnage. Visual observation and placed into three groups, less than 10 tons per acre, 10 - 25 tons per acre, and more than 25 tons per acre.

(5) Soil conservation measures to be stated as whether contour work done or not and only applies to plots reported as hilly.

(6) (a) A, rows along beds; X, row across beds; O, land not in beds.

(b) Pace four adjoining rows and enter average distance between rows.

(7) Notes are to be made when answers cannot be readily tabulated.