THE SPATIAL STRUCTURE OF BARBADIAN PEASANT AGRICULTURE

by

Janet D. Henshall, B.A.

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Department of Geography,
McGill University,
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(P) denotes photograph

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INTRODUCTION

This study is based on twenty weeks field work in the Caribbean during the months of May, June, July, August and September, 1963. Three weeks of this time were spent working in the libraries of the University of the West Indies at Mona, Jamaica and St. Augustine, Trinidad and of the University of Puerto Rico at San Juan, Puerto Rico. Brief visits were made to other islands, for example Tobago, St. Lucia, Martinique, Antigua and St. Maarten, for comparative purposes.

The research project was undertaken as part of the McGill University Geography Department Tropical Programme. In Barbados the Programme has emphasised research into land use and the development of peasant agriculture. This study was designed to continue and complement the work done by other graduate students in this field since 1960. The writer has gained a great deal from this background of research and from the experience of previous workers.

The spatial structure of peasant agriculture is examined at all levels; from the ecological study of individual crops, through land use, to the recognition of regions. The report is organised in three parts: the first consists of a discussion of the field methodology, in the second an outline of the development and present nature of peasant agriculture is given and the third part contains the factor analysis of the fieldwork data. It is hoped that this approach provides an understanding of small farming in Barbados which will be of use to other workers.

CHAPTER 1

THE PURPOSE AND METHOD OF THE STUDY

The primary purpose of this study is to provide an understanding of the spatial structure and basic element-complex of small farming in Barbados. It is suggested that the period since the last survey of peasant agriculture (Halcrow and Cave, 1947) has been one of rapid and far-reaching change in the Barbadian environment and in order to appreciate this more fully both the dynamic and static aspects of peasant agriculture are considered. It is hoped that the knowledge thus gained will be of use in planning for agricultural development. In particular it may help towards a re-examination of the role of the small farmer in the predominantly 'plantation' agriculture of Barbados.

Taking into account the purpose of the study and the previous work done in Barbados it was decided that the most appropriate fieldwork method was to take a stratified random sample of areas under peasant agriculture. The peasant farm was defined, following the official delimitation used by the

Barbados Government, as any farm of less than 25 acres total area.

The sampling approach allows estimates to be made for the universe and yet at the same time the size of the island (106,000 acres) permits intensive study of individual farms. Thus in Barbados the conflict between the intensive and the extensive survey methods which Edwards (1961) experienced in Jamaica is not met in its acute form.

In the evaluation of the results of the fieldwork the technique of multi-variate analysis known as factor analysis has been used. This enables the identification of the fundamental structure of peasant agriculture and of farming types and regions based on a wide range of variables.

The main substantive contribution of this survey lies in its completion of the trilogy of census, survey and case study described by Beckett and Anyane (1956). The Barbados Government undertook an agricultural census in 1959 and in 1961 the Federal Government organised another agricultural census on the island[1]. McGill University Geography Department has had two graduate

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1 - The results of the 1959 census have never been processed and for the 1961 census only preliminary figures are available. This latter census was limited to farms of less than five acres. W.R.E. Nanton, Agricultural Survey Officer, personal communication, December 24th, 1963.

students working on case studies of peasant farming communities in Barbados (Mbogua, 1961 and Brack, 1960). All these studies of peasant agriculture have taken place within three years of each other and therefore can be considered complementary. The conclusions which emerge from this wealth of information on Barbados may be applicable to other areas of the tropics where the problems are essentially similar.

Methodology

It is hoped that this study may make some contribution to the methodology of agricultural survey in the tropics. As noted by Beckett and Anyane, "At the present stage of development in technique, surveys will be partly experimental and constitute research into method as well as being pieces of applied research"[1]. At the same time geographers have seen the importance to the development of their subject of an understanding of the sampling methods devised by students of other disciplines (Whittlesey, 1954, McCarty, 1954, Wood, 1955 and Chapman, 1963). Birch (1954) and Blaut (1954 and 1959) have both stressed the role of the agricultural geographer in surveys. "Regional geography, by virtue of its breadth of scope and precise field

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1 - Beckett, W.H. and Anyane, S.L. "Agricultural Surveys with Particular Reference to Tropical Forest Conditions". Tropical Agriculture. London, 1956. Vol. 33. No. 2. p. 102.

techniques should qualify for a central role in agricultural development research in underdeveloped areas - more so than any specialised discipline"[1]. This can be done by adopting "a field approach combining micro-geographic techniques with formal, i.e., statistically representative sample design"[2]. The efficacy of this general approach and the various ways of collecting particular data have been tested in the Barbadian setting; the understanding thus gained may lead to the devising of new methods for further field studies.

Field Methodology. The method employed in this study is described in detail. This enables the reader to make a more informed assessment of the limitations and reliability of the data presented than would otherwise be possible. The main topics dealt with are the following: the general approach and comparison with other surveys, the reasons for choosing Barbados, the sampling method and collection of data, the questionnaires, and a brief appraisal of the method.

Previous Work. There have been large scale investigations of agriculture such as those of Buck (1956) and Galletti,

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1 - Blaut, J.M. "Microgeographic Sampling: A Quantitative Approach to Regional Agricultural Geography". Economic Geography, 1959. Vol. 35. No. 1. p. 79.

2 - Ibid.

Baldwin and Dina (1956) where the size of the area precluded the use of a statistically valid sample and the authors had to show that the farms studied were representative of the universe of farms. Hill (1956) in Ghana and Edwards (1961) in Jamaica were less ambitious and in their 'pilot studies' did not claim that the samples considered gave a complete picture of the farming in the area. The Imperial College of Tropical Agriculture in 1947 organised a series of pilot studies in a relatively small area of Trinidad and was able to gain a fairly thorough knowledge of the nature of peasant agriculture within the limits of the area surveyed. Geographers in the various studies of the World Land Use Survey (Callender and Henshall, 1960 and Niddrie, 1961) have described and mapped the total area but have failed to give intensity of detail to the individual farm. This study attempts to give a clear picture of the micro-region, the farm, as well as sampling in such a way as to allow estimation for the macro-region.

Previous workers have either studied tropical agriculture from the point of view of 'what is' as in the Land Use Surveys or 'what should be' as in the experimental farm approach (Jolly, 1954). Edwards (1961) tried to determine 'what is' and 'what could possibly be'. In order to discover the feasibility of changes he looked at the farmer's motivations and attitudes. The Barbados study carries this approach one step further and

attempts to provide some quantitative measurement of these subjective, qualitative variables. A further difference between the two island studies lies in their use of farming regions. Edwards' work in Jamaica was based on farming regions already defined for him by local officials. This a priori knowledge was not used in Barbados where the survey was based on the 'region construct' approach.

The choice of field method is not only dependent on theoretical considerations but also on practical considerations such as cost, time and assistance available. In addition the type of terrain to be covered and the previous work done in the area must be taken into account.

The Choice of Barbados. Barbados was selected as the research area primarily because McGill University has a field station there and it is an area within which graduate students have already undertaken some studies of peasant agriculture. Also McGill University has built up over the years an excellent relationship with the Barbados Government Department of Agriculture, Lands and Fisheries, whose assistance was invaluable in this study.

Secondly the gentle, undulating terrain of this small densely-populated island, well-served by roads and bus services,

made possible a survey of the whole island within one field season. Barbados has remained British since the first settlement in 1627 and so cultural and language difficulties for the field party were at a minimum. The Barbadian literacy rate is very high and educational facilities are amongst the best in the Caribbean[1]. The majority of farmers were able to appreciate that the research project was an attempt by the university to learn more about the problems of the small farmer with the eventual aim of helping him to solve these problems. Publicity for the project was relatively easy since the island is served by two daily newspapers and Rediffusion wireless service. Finally both Agricultural Officers and farmers had some familiarity with questionnaires since they had experienced a census of agriculture in 1959 and 1961.

Sampling Method. Anderson's map (1960)[2]. (Figure 1) showing the distribution of peasant agriculture was used to define the universe. Changes since publication of the map became evident in the field but these were only marginal. A grid of one inch squares was placed over the map. The number of squares containing peasant agriculture was counted. These

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1 - Codrington College was founded in 1745 as the first centre for higher education in the British Caribbean.

2 - Anderson, J. Land Use Map of Barbados. 1960. Based on air photo coverage, 1951, and ground survey.

Figure 1 - Distribution of Peasant Agriculture

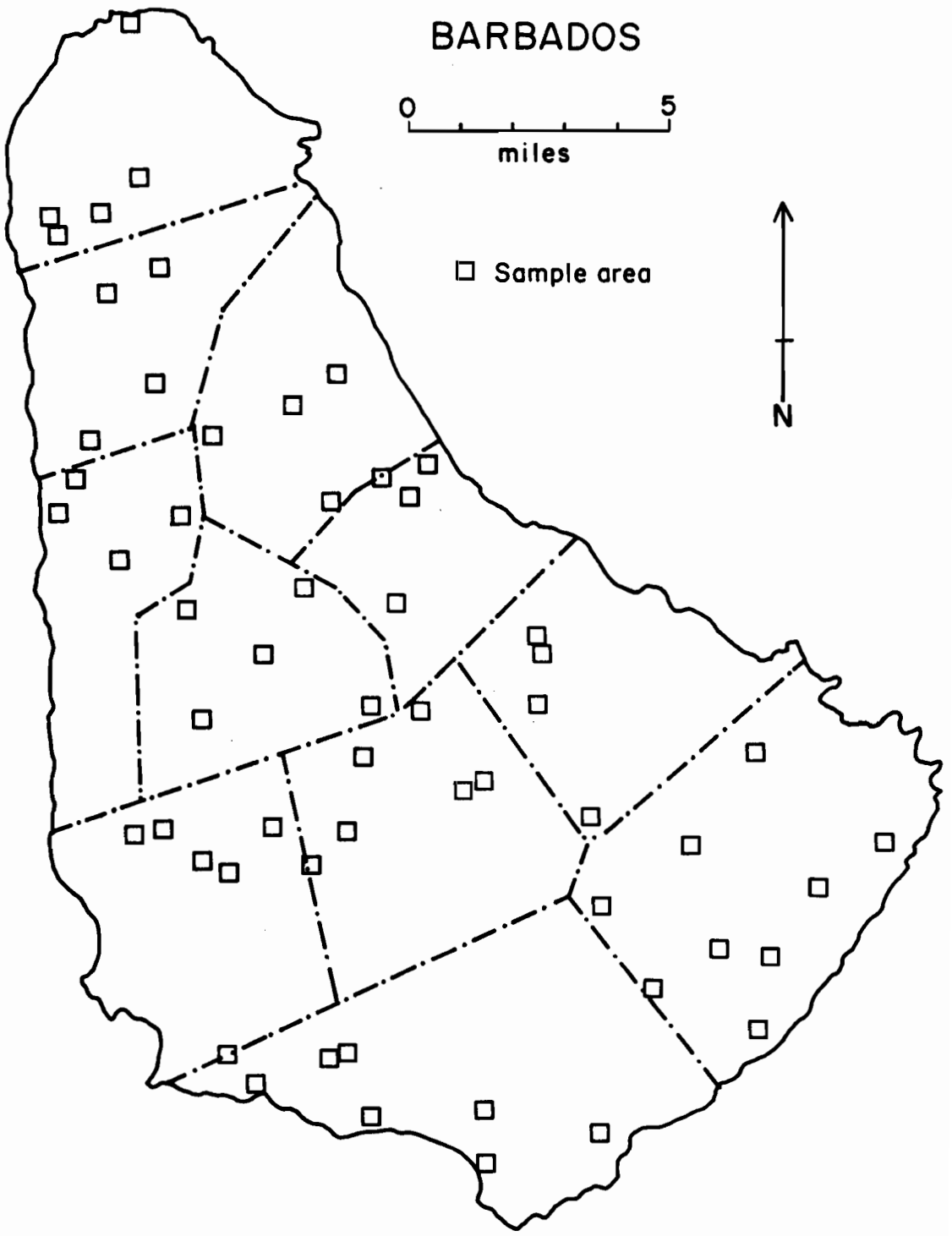

Fig. 2 Location of Sample Areas

squares were then divided into those with less than 25% peasant agriculture and those with more than 25% peasant agriculture. Then, observing this dichotomy, 10% of those in each group was selected for every parish in the island, from a table of random numbers. The total number of squares selected was 58 and the area represented by each square was approximately 70 acres, (Figure 2). This method of obtaining a random stratified areal sample gave a wide coverage of sample areas throughout the island so that every combination of soil and rainfall found on Barbados was represented. In addition it reduced the tendency for clustering of sample areas in a few zones of major concentration of peasant agriculture while allowing for the thorough sampling of isolated groups of small farms whose characteristics were of no less interest to the research worker.

Each of these sample areas was outlined on a 1:10,000 topographical map in order to assist identification in the field. One copy of the map was given to the Peasant Agricultural Instructor for that area and he was asked to list the small farms in the sample area. From this list two farms were selected for intensive study, one of less than one acre and one of more than one acre wherever this was possible. This gave some over representation of larger farms in the sample but this was compensated for by the more complete picture of peasant

farming yielded by these larger farms. The research worker or her assistant visited each of these farms personally and completed the questionnaires (see Appendix 1). For one farm in every sample area the farm survey was completed and a soil sample taken. In addition the Agricultural Officers were asked to fill out the main questionnaire for every fifth farm in each sample area. A few representative farms were surveyed and mapped.

Figure 3 - Farms Sampled - Barbados 1963

	Number of Farms
Questionnaire No. 1 - Land Use and Population	213
Questionnaire No. 2 - Socio-economic factors	116
Questionnaire No. 3 - Physical farm survey	58
Farm maps	5

With the selection of only a few farms in each area the field worker did experience the difficulty envisaged by Kerr, that "the people thus selected might be very suspicious that the field worker was gathering information for a new tax"[1]. However, the problem was quite easily overcome by pointing out that tax collectors would go to every house.

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1 - Kerr, Madeline. Personality and Conflict in Jamaica, Liverpool University Press, 1962. 210 pp.

In some cases the Agricultural Officers were unable to complete the list of farms before the survey began and in these instances the selection of sample farms had to be done arbitrarily in the field. The farms for intensive study were selected at random bearing in mind the size differential. The additional farms chosen were picked at intervals of 5 along radii from the centre of the sample area.

The Questionnaires. The first month on the island was spent designing and testing the questionnaires (see Appendix 1).

The main questionnaire (No. 1) was based on that used in the 1961 Census since this gave the double advantage of familiarity of question for the Agricultural Officers and the possibility of some comparison of results with the earlier census. However, it was modified somewhat by the experience of other workers (Hunt, 1952, Haswell, 1953 and 1963, and Edwards, 1961). Much of this additional material was incorporated in the socio-economic questionnaire (No. 2). The third questionnaire was closely related to the fractional code system used in the Puerto Rico Land Use Survey (Northwestern University, 1952). It was hoped that the combination of questionnaires would give a more complete picture than that generally obtained from agricultural surveys.

These questionnaires were given a preliminary testing in the field. The framing of the questions and the order of presentation were tested on a few selected farmers. A general reconnaissance survey of the peasant farmers of the island was undertaken in company with the Agricultural Officers. Then the research worker was given time on the Rediffusion service to explain the purpose of her survey and to ask for the co-operation of the farmers. Finally a meeting of Agricultural Officers was held at which the research worker explained the content of the questionnaires and the method to be followed in completing them. As the work continued further publicity was given by both the Rediffusion service and the two newspapers at intervals to revive the interest of the farmers and keep the survey in the forefront of their minds. The newspapers published photographs of the research team at work on various farms and the chance of a photograph in the newspaper made the majority of farmers consider a visit from the team a great honour.

Appraisal. In the execution of the field plan various problems arose. The study would not have been possible without the assistance of the Officers of the Extension Service of the Agricultural Department but they had the difficult task of combining the field work with their normal duties.

This presented two basic problems in the field. It had been hoped to complete the primary coverage of the island in as short a period as possible in order to reduce variation due to seasonal cropping differences. The period chosen was that following the cane harvest when the area under vegetables and food crops was at its maximum thus giving the widest range of land use. Most of the field work was done in six weeks in June and July. However in the northern part of the island the first visit was not possible until August and owing to pressure of other work the Agricultural Officer was not able to complete the survey until the end of September. Despite this long time span there was no major change in the seasonal land use pattern and it was felt possible to accept the comparability of the results from the different sample areas.

The second problem arose in the choice of sample unit. When the operator of the selected farm was away from home the shortage of time available to the survey team ruled out further visits. The interviewer had to either ask another member of the family to complete the questionnaire or to substitute another farm. The former method was followed in the majority of cases and it was generally possible to obtain the information requested from the wife or elder children of

the farm operator. When this method failed substitution was undertaken and this may partly account for the high percentage of retired farmers in the sample.

The advantages and disadvantages of the field method may be summarised in this way. On the credit side the information gained has enabled a more thorough understanding of Barbadian peasant agriculture and of the relationship of the farmer to his physical, economic and social environment, than had been possible hitherto. Also this information was collected in such a way that it was possible to apply sophisticated statistical techniques to the analysis of the data and thus obtain a more exact and refined evaluation. A disadvantage of this method of survey is that it needs the co-operation of many people. On Barbados not one of the 116 farmers selected for intensive study gave anything less than their full co-operation. In other areas due to cultural and educational differences the co-operation might not be so easy to obtain. However by utilising to the full the facilities and advantages offered by Barbados it has been possible to apply certain research methods and it is hoped that the experience gained will be of use to other workers in the same field.

CHAPTER 2

THE DEVELOPMENT OF PEASANT AGRICULTURE

Peasant agriculture in Barbados may be said to date from the emancipation of slaves in 1834. Earlier attempts at small farming were not very successful. The indentured white servants of the first settlers were often granted a few acres of land on completion of their term of service. However with the introduction of 'modern sugar works' in 1642 the large plantation became the most economic unit and the small farm rapidly disappeared[1]. This trend was viewed with alarm and laws were passed to encourage the introduction of 'Christian Servants' to Barbados. Many of these servants were given 10 acres by their masters and came to form the group known today as 'Redlegs'. In the pre-emancipation period there were some manumitted slaves who became farmers,but they were few in number.

These early attempts at small farming can in no way be said to have given rise to contemporary peasant agriculture. This originated in the cultivation by slaves of provision grounds on the plantations. These grounds were generally on

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1 - The number of landholders in Barbados decreased from a total of 11,200 in 1645 to 745 in 1667.

the poorest land of the plantation. The slaves were not encouraged to be completely self-sufficient but they were sometimes allowed to sell surplus crops produced. After emancipation, in order to prevent the former slaves moving off the plantation and leaving the labour force, the 'located labourer' system was introduced[1]. Under this system the plantation allotted the labourer a small piece of land, one-eighth to half an acre, rent free, or for a nominal rent, on condition that he continue to work for the plantation. This system was fairly successful in stabilising the labour force and in perpetuating the provision ground system. Perhaps the most important factor limiting the development of peasant agriculture was the lack of free land in Barbados, as compared to the other West Indian territories. As early as 1676 it was said that "There is not a foot of land in Barbados that is not employed even to the very seaside ... so that whoever will have land in Barbados must pay dearer for it than for land in England"[2].

The former slaves were not encouraged to become peasant farmers. On the contrary Shephard points out that "the

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1 - The 'located labourer' system was abolished in 1937.

2 - Letter from Governor, Sir John Atkins, to the Lords of Trade and Plantations, July 4th, 1676. Calendar of State Papers, Colonial Series. p. 421.

policy of the British Government was to make it difficult for labourers to acquire smallholdings in order that they would be compelled to work regularly for wages and thereby assist to maintain the staple industry, sugar"[1]. It was not until 1897 that there was a major policy change. The Royal Commission of that year may be regarded as the Magna Carta of the West Indian peasant according to Shephard. This Commission recognised small farming as the sine qua non of development in the West Indies and thus gave the peasant farmer a position in society he had not hitherto enjoyed. In its report the Commission stated that "no reform affords so good a prospect for the permanent welfare in the future of the West Indies as the settlement of the labouring population on the land as small peasant proprietors; and in many places this is the only means by which the population can in future be supported"[2].

The Commission goes on to point out that "it is not impossible for the two systems of large estates and peasant holdings to exist side by side with mutual advantage"[3], and also appreciated the importance of the presence of peasant

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1 - Shephard, C.Y. Peasant Agriculture in the Leeward and Windward Islands. (Publishers not specified) 1945. p.2.

2 - Report of the Royal Commission on the West Indies, London. 1898. p. 116

3 - Ibid. p. 117.

agriculture *per se*. "The existence of a mass of small proprietors among the population is a source of both economic and political strength"[1]. The Sugar Commission of 1929 included a consideration of peasant agriculture in its terms of reference and during the 1930's the Department of Agriculture in Barbados began to direct its attention to the problems of the peasant farmer. In 1931 credit and co-operative societies were started and in 1933 a co-operative marketing project was initiated. These attempts were short lived but in 1936 the Department of Agriculture appointed to its staff a Peasant Agricultural Instructor, and the report of the following year stated "It is considered that the future work of the Department of Agriculture must be directed more and more towards the improvement of peasant agriculture"[2]. By 1944 the number of Peasant Agricultural Instructors had increased to twelve, six of whom were attached to Agricultural Stations designed to provide models for improved peasant farming. In 1945 Engledow in his Report on Agriculture in the West Indies for the Moyne Commission stressed the need for education for peasant farmers. He added that despite its century of existence little was known about small farming, "Peasant

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1 - Ibid. p. 115.

2 - Saint, S.J. Report of the Department of Science and Agriculture, 1937-8. Advocate Ltd. Barbados. p. 1.

agriculture in the West Indies is admittedly an obscure confusion of systems and holdings"[1]. Today the Extension Section is an important branch of the Department of Agriculture and is directed by highly qualified senior men. The approach of independence and the possible ending of the sugar agreement with the United Kingdom after 1971 are causing a renewed interest in peasant agriculture in Barbados and in its relationships with plantation agriculture.

Changes in government policy with regard to peasant agriculture have generally post-dated an increase in the number of smallholdings and have been declarations of recognition of the status quo rather than mandates for development. The table (Figure 4) is an attempt to provide a quantitative outline of the development of Barbadian peasant agriculture over a period for which statistics are difficult to obtain. Direct comparison of changes from year to year is impossible because of differences in measurement and classification, but it is possible to study trends throughout the period.

When apprenticeship ended in 1838 the movement away from the plantation experienced elsewhere in the West Indies was restricted by the lack of free land. Many of the former

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1 - Engledow, F.L. Report on Agriculture, Fisheries, Forestry and Veterinary Matters. West Indies Royal Commission Report, Cmd. 6608. H.M.S.O. London. 1945. p. 23.

slaves moved into the major settlement, Bridgetown, which by 1851 contained one-fifth of the island's population[1], but a few settled around the houses of manumitted slaves[2], or obtained land from 'Redlegs'. Very few could afford to buy land at a minimum price of £80 sterling per acre whilst wages for agricultural labourers were only 5d. to 8d. per day. At this time in Trinidad and Jamaica wages ranged from 2/6 to 5/- sterling per day and land was readily available at £1 sterling per acre[3]. According to the Barbados Magistrates Reports for 1841 "Most labourers have returned to the estates they left on August 1st, 1838. Others have gone into domestic service or trades or crafts"[4].

In 1847 the West India Bank failed and a few marginal estates were broken up and sold out in small lots. As can be seen from the table, by 1851 there were 3,537 peasant proprietors in Barbados who formed 2.9% of the total population as

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1 - Davy, J. 'The West Indies before and since slave emancipation'. London. 1854. p. 513.

2 - There were between 3,000 and 5,000 manumitted slaves in 1834.

3 - Half yearly agricultural reports. Parliamentary Papers. 1842. XXII.

4 - Dispatch from Mr. President Brathwaite to Lord John Russell, June 17th, 1841. Reports of Police Magistrates. Parliamentary Papers. 1842. XXII. Encl. 2.

FIGURE 4

THE DEVELOPMENT OF PEASANT AGRICULTURE IN BARBADOS, 1851-1961.

	Peasant Agriculture			
Year	Population Density per Square Mile	Number of Holdings	Acreage	Notes
1851	817	3,537		Number of holdings owned 32,112 agricultural labourers
1915	1,036 (1911)	14,000		Holdings under 5 acres
1929	943 (1921)	18,000		Holdings under 10 acres
1935		17,731	11,764	Holdings under 5 acres
1939		18,805	16,000	Holdings under 30 acres
1941	1,159 (1943)	14,000		Holdings under 1 acre
1946	1,161	26,515 30,752 30,630	17,283	Holdings under 1 acre Holdings under 10 acres Holdings under 5 acres
1961	1,399	27,838	11,837 18,321	Holdings under 5 acres Holdings under 25 acres 19,596 agricultural labourers

Sources: 1851 Mathieson, W.L. 'The Sugar Colonies and Governor Eyre, 1849-66'. London. 1936.

1915 'Report of Department of Science and Agriculture for 1915'. Barbados. 1915.

1929 Skeete, C.C. 'The Condition of Peasant Agriculture in Barbados'. Advocate Co. Ltd. Barbados. 1930.

FIGURE 4 - Contd.

1935 "A report on the present condition and future outlook of the sugar industry of Barbados by the delegates appointed by the legislature of Barbados". Draft prepared by Sir John Saint and forwarded to Mr. Walcott, the Hon. Solicitor General when Sir John was acting Director of Agriculture. August 21st, 1935. Tables I and II.

1939 Engledow, F.L. Op. cit.

1941 Agricultural Development in Barbados. Advocate Co. Ltd. Barbados. 1943.

1946 Halcrow, M. and Cave, J.M. 'Peasant Agriculture in Barbados'. Bulletin No. 11. Department of Science and Agriculture, Barbados. 1947.

1961 'West Indies Census of Agriculture, Preliminary Returns'. Barbados. 1962.

1911, 1921, 1943 Population densities from Roberts, G.W. Population of Jamaica. Cambridge. 1957.

1961 Population density. West Indies Population Census. 1961.

compared to the 7.1% (1848) in Trinidad and 11.3% (1860) in Jamaica. At the same time the tenant farmer played a more important part in Barbados than in the other islands. In 1851 there were 32,112 adults working in agriculture many of whom cultivated land on the perimeter of the estates. "Labourers are generally supplied by the estates with cottages and small spots of garden ground; they perform 5 days labour on the estate every week, for which service they are paid without any deduction, but if otherwise a half a bit a day is stopped from their wages for lodging. On many estates the labourers are possessed of allotments of land in addition of from one-quarter to one-half acre for which they pay a weekly rental of a bit and one-half to four bits"[1].

Following the Equalisation Act of 1846 which removed the prohibitive duty on foreign sugar and exposed West Indian sugar to competition from slave-produced sugar from Mauritius and elsewhere, the fortunes of the Barbadian planter fluctuated. The agricultural labourers took advantage of the recurrent crises in the latter half of the nineteenth century and the break up of estates which became uneconomic allowed an increase in the number of peasant proprietors. The 1897 Royal Commission was unable to obtain even an estimate of the

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1 - Ibid. Encl. 3.

number of peasant farms in Barbados but recognised that this class was smaller than on the other islands. It recommended an increase in peasant agriculture. "Amongst the better class of black people cane farming might eventually become an important means of utilising the energies of those who will not work for daily wages on the sugar estates"[1].

However the main peaks in the trend line coincide with inflow of capital to the peasant sector. The first peak occurred at the turn of the century with the return of labourers from Panama, and further peaks coincided with the conclusion of the two world wars when the soldiers returned with their demobilisation grants. These injections of capital were particularly effective because they were synchronised with periods of depression in the sugar industry. The Panama money was available at a time of low sugar prices, deterioration of the Bourbon canes and an outbreak of fungoid disease. The 1914-18 War was a period of boom with rising sugar prices and associated land speculation followed by an immediate postwar collapse which led to the abandonment of many estates. The Second World War was followed by a similar depression in the sugar industry.

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1 - Royal Commission on the West Indies, 1898. Op. cit. Appendix A, paragraph 113.

The number of farms under five acres more than doubled in the period 1915 - 1946, 78% of this increase taking place in the last decade of the period. The apparent decrease 1946 - 1961 is accounted for by the terms of reference of the 1961 Census of Agriculture which excluded all farms of one-eighth acres and under from the enumeration. This category numbered 3,132 in 1946. Holdings under 10 acres increased by two-thirds in the period 1929 - 1946. In the five years 1941 - 1946 the number of holdings under one acre nearly doubled illustrating the intensity of the postwar bulge in the growth rate of peasant agriculture. Over the whole period studied, 1851 - 1961, the number of peasant holdings increased ten times and peasant proprietors increased their percentage of the total population from 2.9% to 10.2% in 1946 falling to 8.6% in 1961. During the same one hundred and ten years the number of agricultural labourers showed an absolute decrease from 32,112 to 19,596. A study of the growth pattern of acreage under peasant agriculture shows a much slower rate of increase. Between the years 1939 and 1961 the acreage increased only 15% whilst the number of holdings increased 65%. In the period 1935 - 1961 the acreage in farms under five acres increased by only 73 acres. This would indicate that the average size of holding has decreased. It may be a reflection of frag-

mentation resulting from inheritance, or of the increase of capital in the peasant sector due to postwar wage increases which has enabled many people to satisfy their desire to become land owners per se although the size of holding makes it impossible for them to become full-time farmers.

The growth of peasant agriculture may generally be said to date from 1895 but as Halcrow and Cave point out "The development of peasant holdings has not proceeded very far"[1]. This situation may be explained partly by the fact that the attempt to develop peasant agriculture occurred at a period of increasing population pressure on the land and also because, unlike their counterparts elsewhere in the West Indies, the Barbadian planters were able to achieve and maintain a high standard of scientific and efficient farming.

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1 - Halcrow and Cave. Op. cit. p.v.

CHAPTER 3

CHARACTERISTICS OF PEASANT AGRICULTURE

Geographical Background[1]. Barbados is the most easterly of the West Indian islands; it lies at latitude 13°4' North and longitude 59°37' West (see Figure 5). The island is 21 miles long and 14 miles wide with an area of 166 square miles or 106,470 acres. It is generally low and windswept but rises to 1,104 feet at Mount Hillaby in the Scotland District in the north-east of the island. On the south and west the land falls in a series of steps, marked by cliff-like outcrops of coralline limestone, to the sea. Permanent streams are virtually absent and drainage is generally sub-surface.

Geologically Barbados is a remnant of an ancient continent. Sedimentary strata of continental origin underlie the coral and appear at the surface in the rugged, deeply-dissected Scotland District. In this area the soils are derived from sandstones and oceanic clays but elsewhere on the island they

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1 - For a detailed description of the geography of Barbados see Otis P. Starkey. "Economic Geography of Barbados". Columbia University Press. New York. 1939. 228 p.

Published by Directorate of Colonial Surveys D.C.S. 955.
Second Edition.
IQ000/6/56 S.P.C.R.E.

Compiled and drawn by Directorate of Colonial Surveys.
Photographed by D.C.S. and printed by G.S.G.S. 1956.

Figure 5 - Barbados - Location

BARBADOS-SOILS

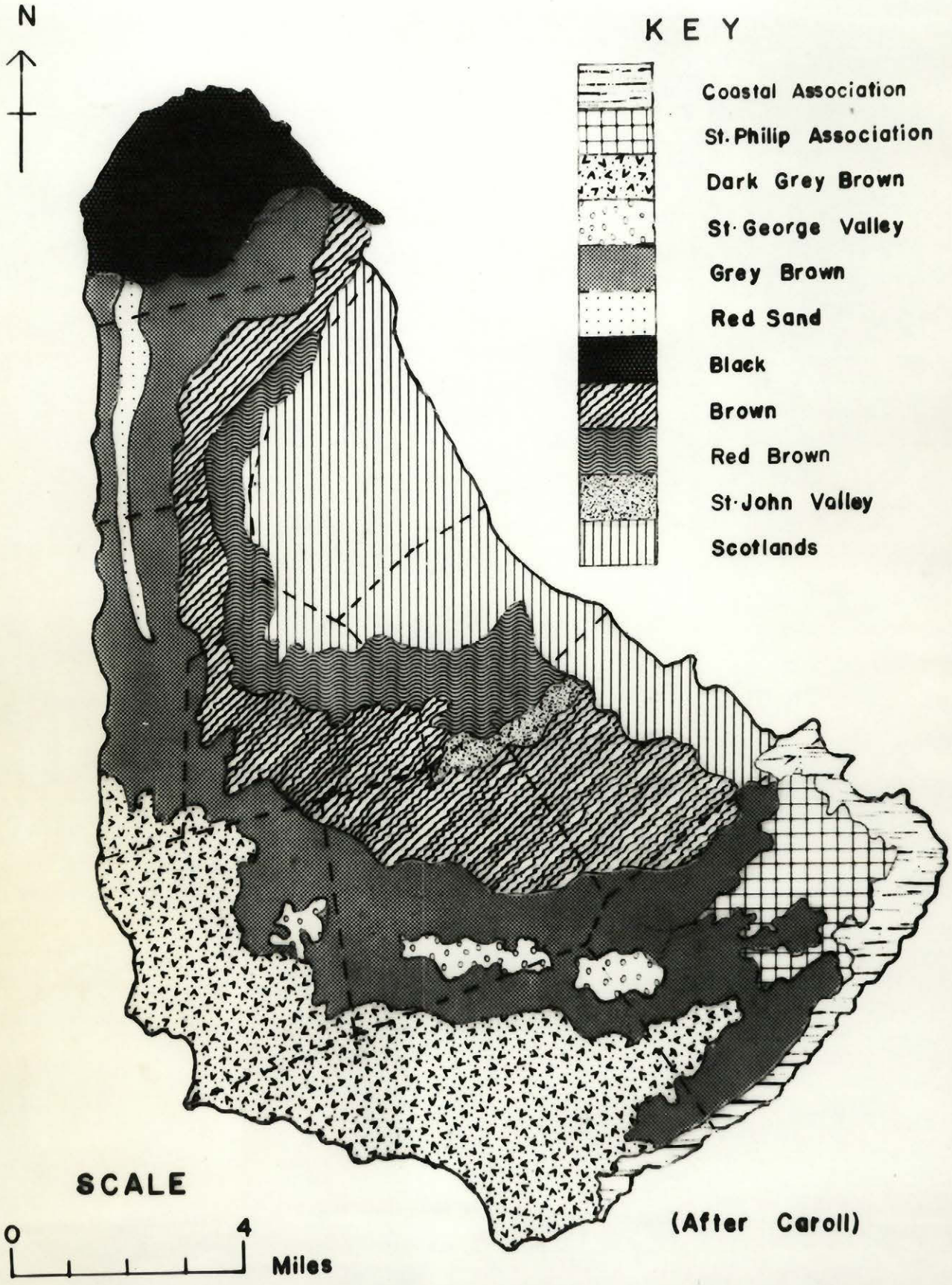

Figure 6

BARBADOS

MEAN ANNUAL RAINFALL

(Inches)

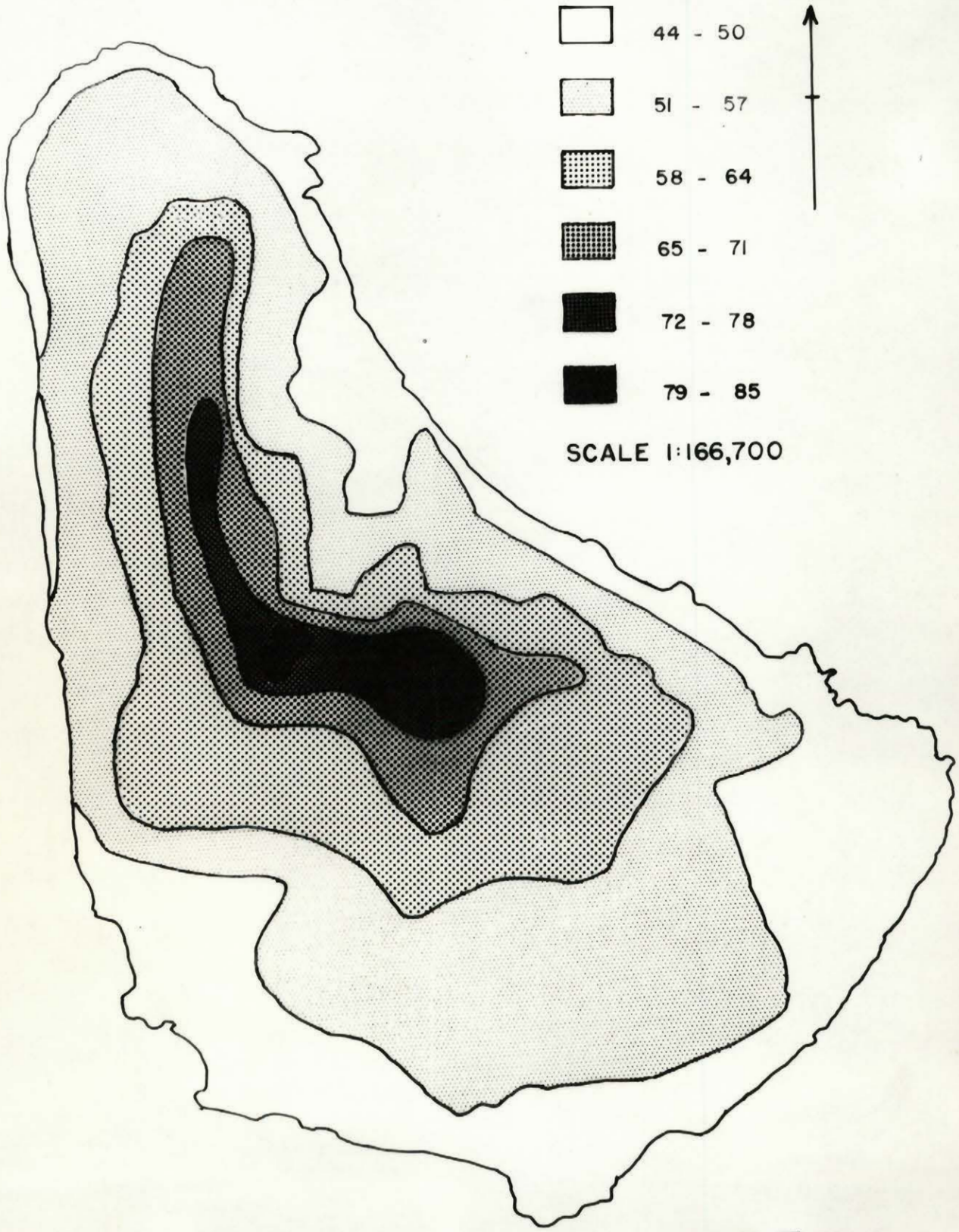

FIGURE 17

have developed *in situ* on the coralline limestone. Windborn volcanic ash from the eruption of the Soufriere of St. Vincent in 1902 forms a deposit in many of these soils. All the soils are highly alkaline and tend to be deficient in nitrogen and potash[1]. The coral soils are black near the coast changing through brown to red towards the higher elevation of the interior (Figure 6).

The climate of Barbados is subtropical and oceanic with a constant seabreeze of about 10 m.p.h. from the north-east. Precipitation ranges from 75 inches per year at the highest elevations to 45 inches at sea-level with a mean for the whole island of 59 inches (Figure 7). There is usually a dry season from January to June when relative humidity falls to approximately 67%. The temperature remains constant between 75° and 80°F. and the maximum annual temperature range is only 20°F.

There is little undisturbed indigenous vegetation on Barbados. When the first settlers landed the island was densely wooded but there is only a very small remnant of this woodland remaining in the Scotland District. Today the dominant tree is *Casuarina equisetifolia* which has been planted

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1 - Soil samples were taken in each sample area. An analysis of these soil samples showed little variation of pH, all samples falling between 7.5 and 8.5.

as a windbreak in many places. However cultivation is so intensive that the typical landscape is that of sugar cane.

Barbados was first settled in 1627 by the English and has remained a British colony ever since. The population in 1961 numbered 232,330 of which approximately 95% were of African or mixed Afro-European descent. The population density is 1,399 per square mile, making pressure on the land more acute than anywhere else in the West Indies.

The lack of marked physical diversity in the Barbadian landscape makes it possible to base the mapping of the overall pattern of agricultural distributions on the sample area.

Distribution. Land cultivated by small farmers has an uneven distribution pattern with marked clustering (see Figure 1). The parish of St. Philip has the largest acreage in peasant holdings closely followed by Christ Church, St. Andrew, St. Lucy and St. Michael respectively. St. Peter has the smallest acreage with St. Thomas, St. Joseph and St. John next in order. It can be seen that the greatest acreage is in the coastal area of shallow soils and low rainfall, whilst the acreage of peasant land in the high rainfall area is comparatively low. The greatest number of peasant holdings is found in St. Michael, reflecting the importance of the very small holdings concentrating on livestock production for the Bridgetown

market. Christ Church, St. Philip and St. George are also parishes with many peasant farms. St. Joseph and St. Peter followed by St. Andrew and St. John have the lowest number of holdings. The small number of holdings in St. Andrew suggests that in this parish of the rugged Scotland District the peasant has been able to obtain holdings of greater than average size.

The clustering effect is the result of the way in which most of the holdings originated. In 1838 there was virtually no unoccupied land in Barbados and the freed slaves could only obtain land when estates were broken up. Because they are based on sub-division of estates the holdings are found to be associated together in villages of varying size. Halcrow and Cave (1947) recognised 616 of these villages of which this survey sampled 62 or just over 10%. These peasant villages are simple congregations of household units rather than the closely knit human community with marked internal social and economic relationships that the term 'village' usually denotes. However these geographical concentrations of holdings could form useful units for development projects.

A corollary of the method of formation of peasant holdings lies in the quality of their land. The estates which were subdivided and sold were generally those whose land was

marginal for sugar production. The case of tenant farmers has a similar background. The old slave lines were moved out to the perimeter of the estate, to land left uncultivated by the plantation because of its general poor quality or difficult nature. Shephard states that "Much of the land now in the hands of peasant proprietors is handicapped by low fertility, steep slopes or inaccessibility"[1]. Both Shephard and Jolly (1956) stress that peasant land has often become impoverished by poor farming. On Barbados the peasant, following the example set by the estates, appears to be a better farmer than his counterpart on many of the other West Indian islands. At the same time he has suffered most because historically he was the last to bid for land. In the sample of 116 farms studied 55% had soil considered too shallow for successful plant growth whilst 33% had land which was excessively stony or had large areas of rock outcrop. An unfortunate 29% of the sample had holdings which had both the above disadvantages. Steepness of slope is not as common a disadvantage in Barbados as in some of the volcanic islands but 23% of the farms sampled had land which was either steep enough to be subject to erosion, or land which was broken by the depressions typical of a limestone landscape. As might be expected, the farms with

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1 - Shephard. Op. cit. p. 14.

the former problem were found mainly in the Scotland District whilst those with the latter were situated in the south-eastern part of the island.

Perhaps the most important variable to be taken into account when discussing the suitability of an area in the tropics for agriculture is rainfall. In Barbados rainfall is highest in the elevated interior of the island, and this area is considered most favourable to agriculture. There the dry season is shorter than in other parts of the island and seasonal and yearly variation in precipitation is at a minimum. From Figure 8 it can be seen that the majority of plantations are found in the zone of high rainfall while almost two-thirds of the peasant holdings are situated in the low rainfall zone. This difference is significant at the .001 confidence level.

FIGURE 8

THE DISTRIBUTION OF PLANTATIONS AND PEASANT HOLDINGS IN BARBADOS WITH RELATION TO RAINFALL

Rainfall Zone	Percentage of Plantations	Percentage of Peasant Holdings
Low Rainfall 44" - 57"	19.53	60.34
Intermediate Rainfall 58" - 64"	33.98	22.41
High Rainfall 65" - 85"	42.48	17.44

System of Tenure and Land Values. According to Halcrow and Cave (1947), the 1961 Agricultural Census and this study approximately 60% of peasant holdings are owner occupied. The spatial pattern of these farms shows a negative correlation with land value. As Paget has pointed out, "the value of land is no more nor less than the price commanded and recently paid for it"[1]. The price of agricultural land available to peasants has fluctuated considerably. It was lowest before the First World War and rose very rapidly after 1945 (see Figure 9). The areas commanding the highest price consistently have been within the high rainfall zone, for example, the parishes of St. John, St. Thomas and St. George (see Figure 10). However in the last ten years the spatial structure of land values has altered somewhat. The importance of proximity to the metropolis, Bridgetown, and competition for land from the tourist industry has raised prices in Christ Church, St. Michael and St. James (see Figure 10). Figure 11 showing the present distribution of land values on Barbados illustrates this change. The outstanding feature of this distribution is the contrast between the isolated areas such as St. Lucy and St. Andrew with low values and the peri-urban areas with their high values. Nevertheless, the parish of St. John still appears as an island of high priced

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1 - Paget, E. 'Value, valuation and use of land in the West Indies'. Geographical Journal. 1961. Vol. 127, Part 4. p. 493.

land, thus seeming to contradict Halcrow and Cave's statement that in Barbados "the price of land bears little relation to its agricultural value"[1]. When a peasant buys land, the desire to own land and the convenience of the locality as regards roads and water are the most important considerations. The increase in service facilities in many areas has contributed to the rise in land prices. Where this is the case the increased price may be compensated for by the opportunity offered for improvement in agricultural methods.

Other forms of tenure recognised in the sample survey were cash rental, share cropping and land held rent free or for a peppercorn rent. Many of the cash renters were estate tenants but 18% of the peasants in the survey rented land to other peasants. Land held rent free was generally being farmed for absentee owners. Share cropping was found mainly on the poorer soils in the northern part of the island. In many cases two or more types of tenure were found on one holding.

Fragmentation. In Barbados approximately half the peasant holdings consist of more than one parcel of land. This fragmentation has arisen in the majority of cases, not through inheritance but through the owner's efforts to build up a holding piece by piece as land becomes available and savings

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1 - Halcrow and Cave. Op. cit. p. 28.

permit. On an island the size of Barbados it would not be expected that the distance between the homestead and the furthest parcel of land would be very large and the maximum found in the survey was seven miles. However any break in the spatial continuity of the holding can effect the efficiency of its operations (Jolly, 1954 and 1956). Travelling to distant plots restricts the tools that can be used and limits the use of fertiliser, especially of pen manure which originates in the stockyard on the housespot. In the West Indies praedial larceny is a serious problem and consequently the farmer likes to keep crops susceptible to theft under his constant watch. Thus land away from the housespot is generally left under canes and visited only very occasionally. In this way fragmentation leads to the peasant farmer sacrificing his main advantage, that of close supervision of the farm.

Employment. The difficulties which the West Indian peasant faces in his attempt to obtain a viable holding have given rise to one of the most striking characteristics of peasant agriculture in the region, that is the combination of farming and wage labour. The underemployment due to inadequate land is accentuated by the seasonal nature of most production pursued by peasants. Also the seasonal peaks in labour demand on the part of the plantations occur at a time

FIGURE 9

PEASANT AGRICULTURAL LAND VALUES IN BARBADOS SINCE EMANCIPATION

Year	Price (in £ = sterling)
1838	80
1884	79
1907	30
1911	41
1912	46
1913	54
1914	21
1917 - 1940	79
1941 - 1947	129
1960 - 1963	718

Sources: 1838 Parliamentary Papers, 1842.
1884 - 1947 Halcrow and Cave, 1947.
1960 - 1963 1963 Fieldwork.

FIGURE 10

SPATIAL DISTRIBUTION OF PEASANT AGRICULTURAL LAND VALUES IN BARBADOS SINCE EMANCIPATION

Parish	Rate per acre in £ sterling			
	Before 1917	1917-1940	1941-1947	1960-1963
St. Michael	52	90	139	855
St. James	43	56	48	900
Christ Church	66	62	109	937
St. Philip	63	75	88	555
St. John	21	163	250	1,100
St. Joseph	41	60	240	486
St. Andrew	-	48	96	412
St. Thomas	-	98	160	840
St. George	-	79	185	800
St. Peter	32	75	113	570
St. Lucy	-	56	108	448

Sources: 1838 Parliamentary Papers, 1842.
1884 - 1947 Halcrow and Cave, 1947.
1960 - 1963 1963 Fieldwork.

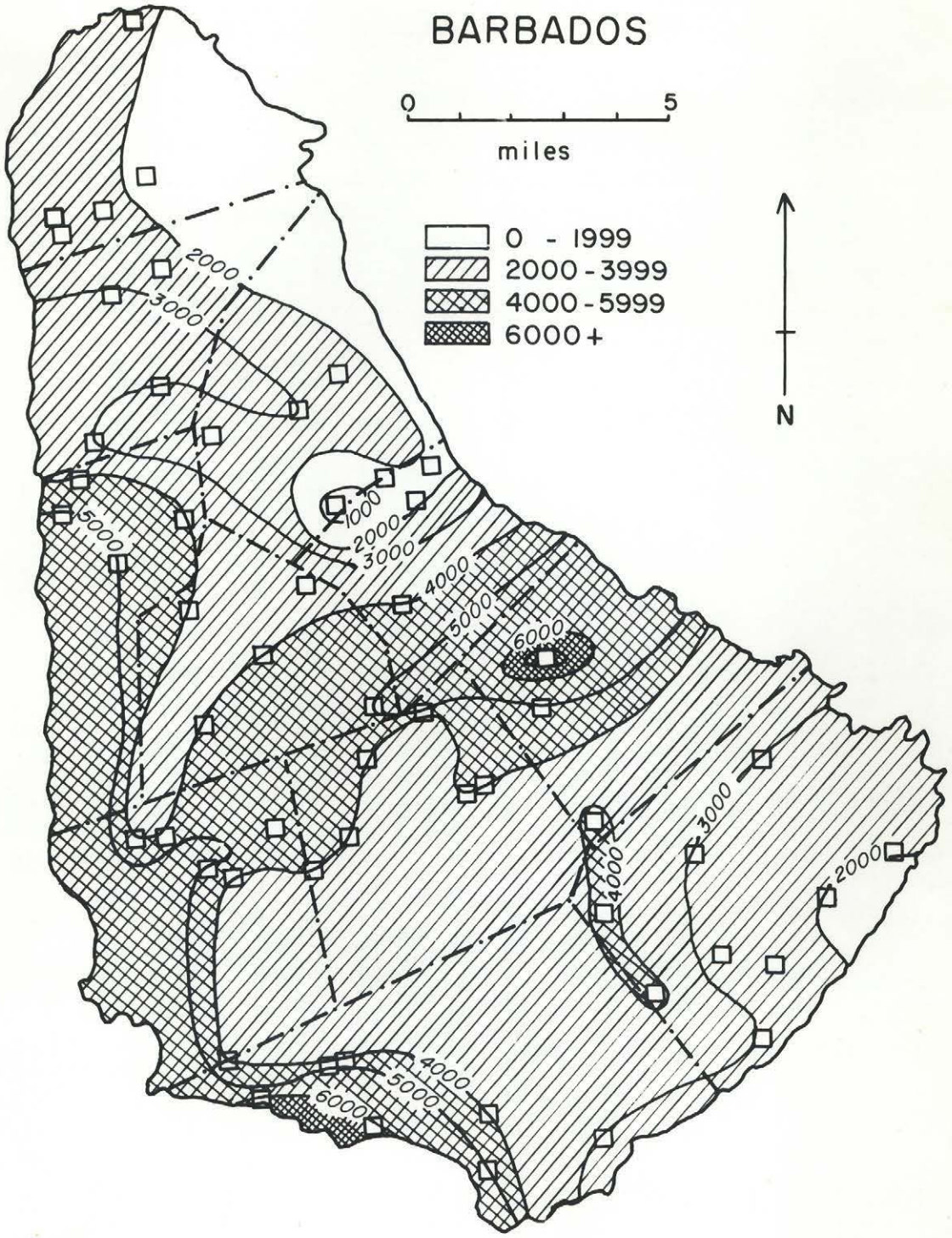

Fig.11 Peasant Farm Land Values 1963 (West Indian dollars per acre)

when labour is needed on the peasant's own holding. Consequently all but the very smallest peasant holdings depend on hired labour at certain seasons of the year, notably at the time of the cane harvest. There is some dependence on unpaid family labour both from the nuclear family and the extended family, but most work is done by paid labourers. The peasant farmer competes for labour with the plantation which can usually offer more work over a longer period. The difficulty of obtaining labour and its high cost were given as major reasons for the failure to increase vegetable production on peasant farms.

In the sample study it was found that the peasant farmer worked an average of three days per week and hired two labourers. It is suggested that this average period of employment reflects underemployment, "which, in this highly populated territory, cannot be as frequently offset by work on small holdings as elsewhere"[1].

The occupations of the peasant farmer are various. (Figure 12). Many are craftsmen who can combine piecework in their trade with agriculture. The agricultural labourers can often obtain only three days work per week on the plantation

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1 - International Labour Office "Labour Policies in the West Indies". Geneva. 1952. p. 90.

out of 'croptime' and the rest of the week is spent on the holding. Those in full time employment generally take little interest in the land, keeping most of their holding in sugar cane which brings the maximum of cash return for the minimum of labour outlay. Many men depend on their wives for assistance on the farm and 29% of the women interviewed take some major part in the organization of the farm. Amongst the remaining 71% most housewives look after the stock-yard or the vegetable garden while in a few cases women combine operation of the farm with other occupations such as hawker or seamstress. If the list of occupations in 1963 is compared with a similar analysis for 1946 (Halcrow and Cave, 1947) the category of full time peasant farmer has fallen from second to fifth position in the list. Engledow suggested that in Barbados holdings with full time farmers constituted only 20% of the total number of holdings[1]. The present survey would suggest that this proportion has fallen to 14%. This change seems compatible with the decrease in size of holding already noted.

Farm Population. The typical farm family consists of five people and is made up of two children under 15 years and either two or three women. If the 42 households without

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1 - Engledow. Op. cit. p. 34. para. 12.

FIGURE 12

OCCUPATIONS OF PEASANTS IN SAMPLE SURVEY, 1963

Men	No.
Agricultural Labourers	43
Retired	15
Shopkeepers	6
Transport	6
Farmers - without other occupation	5
Carpenters	4
Civil and parochial employees	4
Tailors	3
Teachers	3
Sugar factory employees	3
Masons	3
Sextons	2
Butchers	2
Hospital workers	2
Fish seller	1
Leather worker	1
Undertaker	1
Bicycle repairer	1
Blacksmith	1
Motor mechanic	1
Gardener	1
Labourer - cement factory	1
TOTAL	109

Women	No.
Housewives	32
Farmers - without other occupation	25
Shopkeepers	10
Hawkers	9
Retired	8
Agricultural Labourers	8
Domestic Servants	5
Seamstresses	5
Teacher	1
Post Mistress	1
TOTAL	104

Summary

1.	Sugar Industry	56
2.	Permanent secure employment or pension	33
3.	Housewives	32
4.	Marketing, commerce and distributive employment	32
5.	Peasant Farmers - without other occupations	30
6.	Craftsmen	22
7.	Other pursuits	8
	TOTAL	213

Source: Fieldwork

children are excluded (in most of these cases the children have left the farm) then the typical number of children per family is three. These figures illustrate the dominance of women in Barbadian peasant agriculture.

Of the 116 households sampled in detail 52% did not consider agriculture a way of life they wished their children to enter. A large proportion of the remaining 48% consisted of elderly farmers whose children had already left the land. These figures appear to support Jolly's maxim that generally "peasant farming is not the occupation of choice but of last and only resort"[1]. All the farmers interviewed were literate and 61% had children who were receiving, or who had received, secondary education. Many farmers have made great sacrifices to give their children or grandchildren education and training for a job which will ensure that the next generation can escape from the land to more lucrative occupations. Over half the families visited (56%) had close relatives living abroad, generally in the United States or the United Kingdom. Contact is maintained with most of these relatives overseas and in many cases they send money back to the island. Thus the Barbadian peasant does not have the narrow horizons of the traditional peasant farmer.

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1 - Jolly, A.L. Report on Peasant Experimental Farms at the Imperial College of Tropical Agriculture, Trinidad, B.W.I. Trinidad, Central Secretariat, Caribbean Commission, 1954. p. 2.

Technical Level. In 1897 the Royal Commission noted that "The drawbacks to the system of peasant proprietors have hitherto been their want of knowledge and care in cultivation"[1]. Engledow (1945) and Jolly (1956) also regret the lack of knowledge of the peasant farmer. This is a criticism that can scarcely be levelled at the contemporary Barbadian small farmer. Today 56% of the farmers make use of some form of mechanisation on their farms. This generally takes the form of the hire of a tractor from the plantation or agricultural station. If we exclude farms below one-quarter acre whose area is really too small to permit mechanisation, then the percentage rises to 63%.

A further quantitative expression of technical level may be gained from a study of the use of fertiliser by small farmers. In this aspect Barbados has long been ahead of other areas in the West Indies. Shephard notes that "artificial fertilisation of the ground was universally practised in Barbados as early as 1689"[2]. In the survey of 1963 only 5% of farmers used no form of fertiliser and most of this group were special cases in which livestock dominated the enterprise. The most common fertiliser is the duality of potash and sulphate of ammonia which is used on the sugar cane (see Figure 13).

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1 - West Indies Royal Commission, 1898. Op. cit. para. 116.

2 - Shephard. Op. cit. p. 80.

Many of the poorer peasants are able to obtain this from the plantation. The majority of peasant farmers still use the traditional pen manure from the livestock but this is generally reserved for the vegetable garden on the housespot. Sometimes it is put on the ground used for food crops or around the fruit trees. VGM and phosphate are recent additions to the scientific cultivation of sugar cane, whilst fertiliser based on fish is also a modern innovation.

The methods of dissemination of knowledge of new methods, seeds and fertiliser are very important. The Agricultural Department has an hour-long programme every week on the Rediffusion service directed to giving advice to the peasant farmer. The work of the officers of the Extension Section in their individual districts is very important and the clustering, in certain parts of the island, of farms using the new fertilisers indicates the role of these officers as a focal point for the diffusion of ideas. It would appear that the Barbadian peasant learns most readily from the plantation and secondly from a sympathetic Agricultural Officer but rarely from his fellow small farmers.

FIGURE 13

TYPES OF FERTILISERS USED ON RANDOM SAMPLE OF PEASANT FARMS IN BARBADOS, 1963.

Fertiliser	Number of Farms
Potash	149
Sulphate of Ammonia	147
Pen Manure	130
VGM	31
Phosphate	12
Fish Manure	11
Ashes	1

Source: Fieldwork

CHAPTER 4

THE INTRA-FARM PATTERN

A typical feature of small farming in the tropics is intercropping with random mixtures of crops. Within this system certain combinations of crops are generally recognisable and may be correlated with the micro-geographical characteristics of the holdings. Innis (1961) noted the spatial structure of peasant crops in Jamaica and showed how the peasant farms are typified by an abundance of species closely intermingled.

This feature so conspicuously displayed in other parts of the tropics is carefully disciplined in Barbados. In this island cultural features have made a dominant impression on the landscape through their influence on the agricultural pattern. In the monoculture of Barbados all other crops are subordinated to sugar cane. When first introduced in the seventeenth century the cane was planted in furrows but by 1708[1] the method of planting in holes had superseded the earlier method. These 'holes' consist of squares of sides

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1 - Watts, D. '<u>Plant Introduction and Landscape Change in Barbados, 1625-1830</u>'. Unpublished Ph.D. Thesis, McGill University. 1963. p. 298.

approximately five feet. In each square is a hollow of depth 6 to 18 inches and sides two to three feet. The holes restrict soil wash and erosion and allow the most effective use of fertiliser. Immediately after the cane is harvested food crops are planted in the hole. Each crop has certain traditional positions with relation to the structure of the hole (see Figure 14). Maize may be planted on the edge of the hollow or on the mound between two hollows. Yams, eddoes and sweet potatoes are planted around the edge of the hollow as can be seen from the photograph. In November sugar cane is planted in the centre of the hole and grows with the food crops until the latter are harvested in January. The hole has become a stable feature in the landscape and in some areas where the soil cover has been removed the indentations of former cane holes can be seen in the limestone bedrock.

This method of cultivation gives an unusual orderliness to the cropping pattern even on the smallest peasant farm. In the first four Farm Plans (Figures 15 to 19) the pattern of the cane holes can be seen reflected in the layout of plots of vegetables and other crops even where there is no intention of inter-cropping with cane. When a crop is planted pure other crops may be planted to replace individuals of the first crop that fail to grow,thus leading to a secondary development of inter-cropping (Figure 16). In recent years a

Fig. 14 - Food crops arranged around a cane hole.

Fig. 15

KEY TO FARM PLANS

y - Yam
N - Groundnut
P - Sweet Potato
Cu - Cucumber
PP - Pigeon Pea
E - Eddo
x - Maize
O - Cassava
□ Sugar Cane

B - Bananas
Br - Breadfruit
C - Coconut
L - Lemon
M - Mango
GA - Golden Apple
A - Avocado
T - Tamarind
Chr - Christophene

△ Pig Sty

□ Hen House

SCALE

0 10 20 30 40

feet

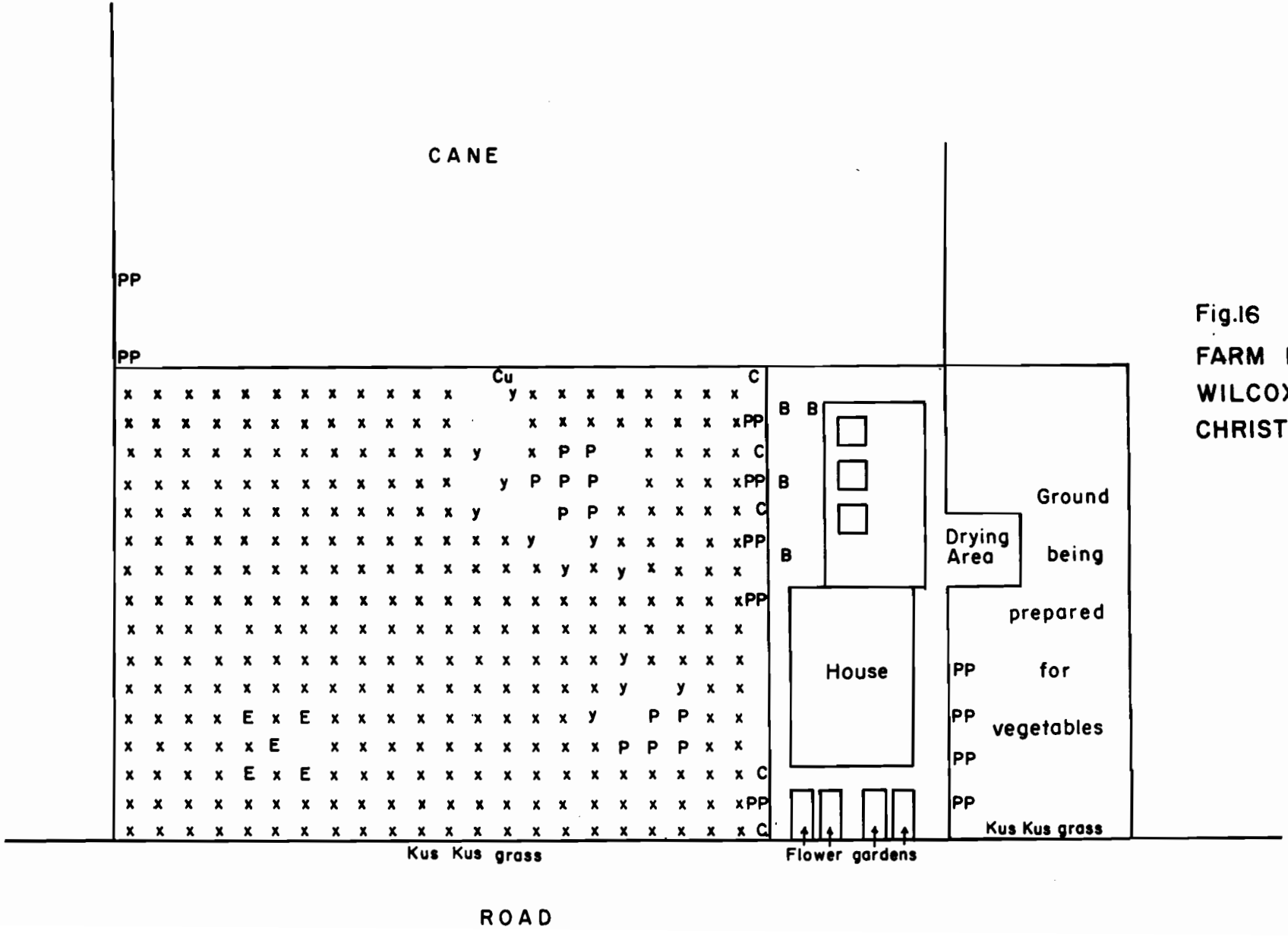
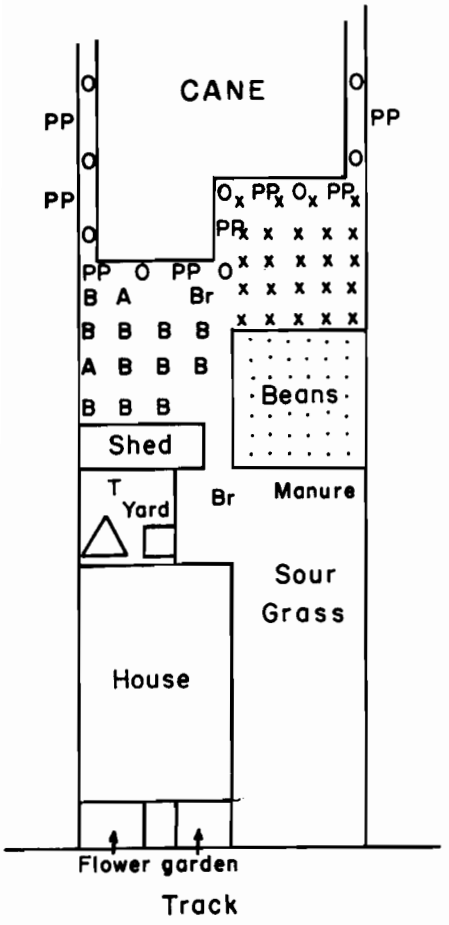


Fig.16
FARM PLAN
WILCOX,
CHRISTCHURCH

Fig. 17
FARM PLAN
JACKMANS,
ST. MICHAEL



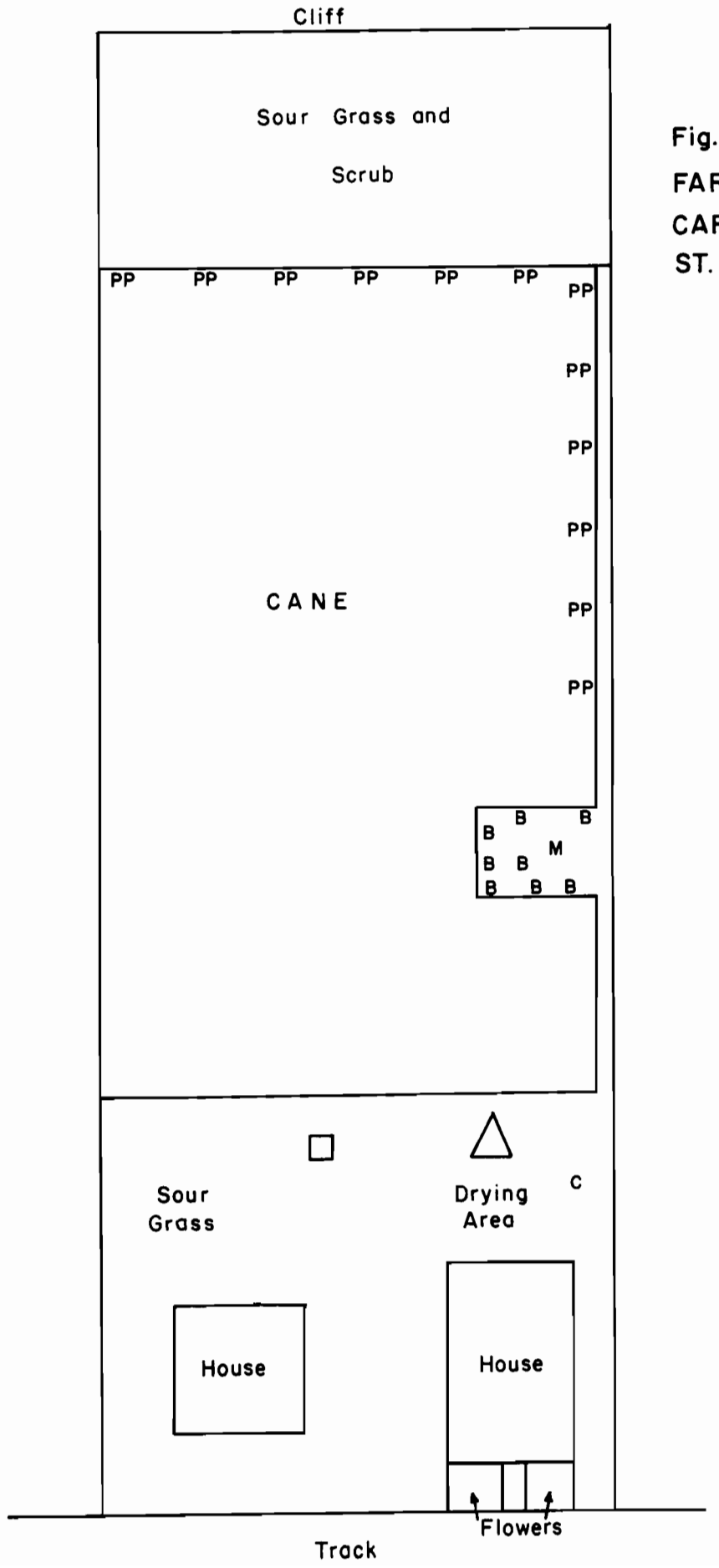


Fig.18
FARM PLAN
CARLTON,
ST. JAMES'

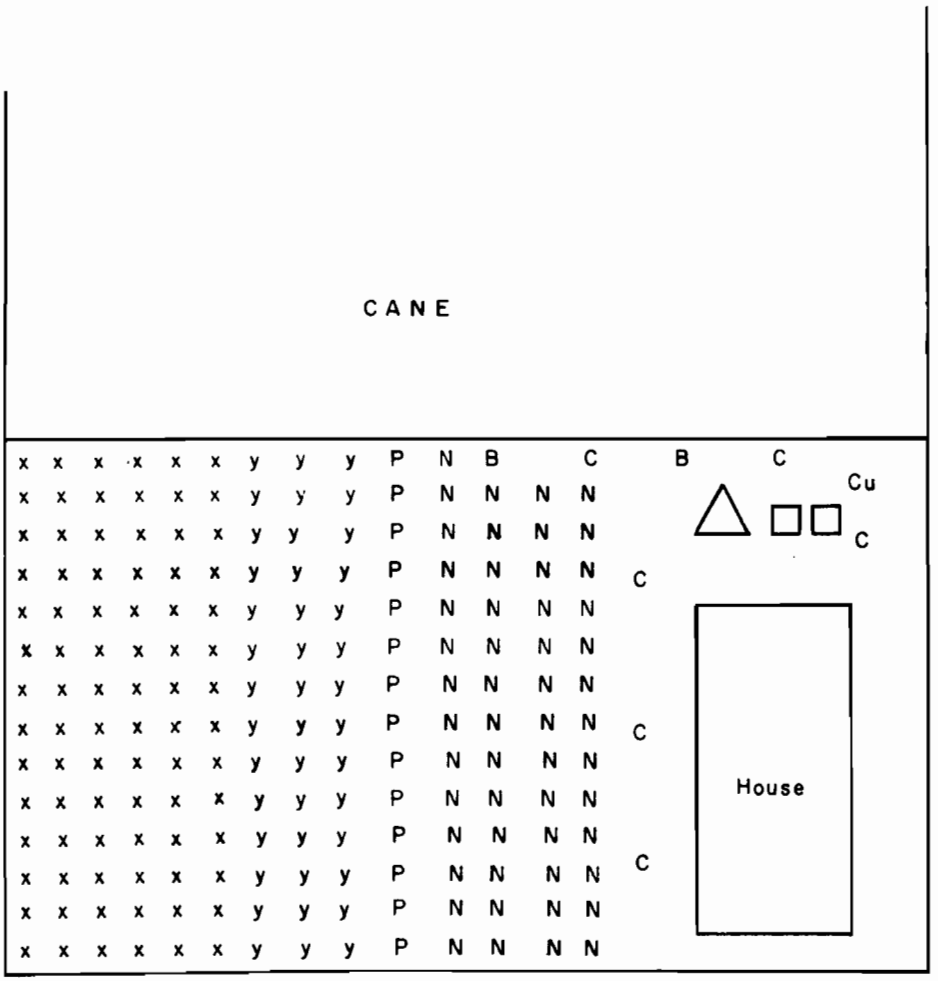


Fig. 19 FARM PLAN, CONNELL TOWN, ST. LUCY

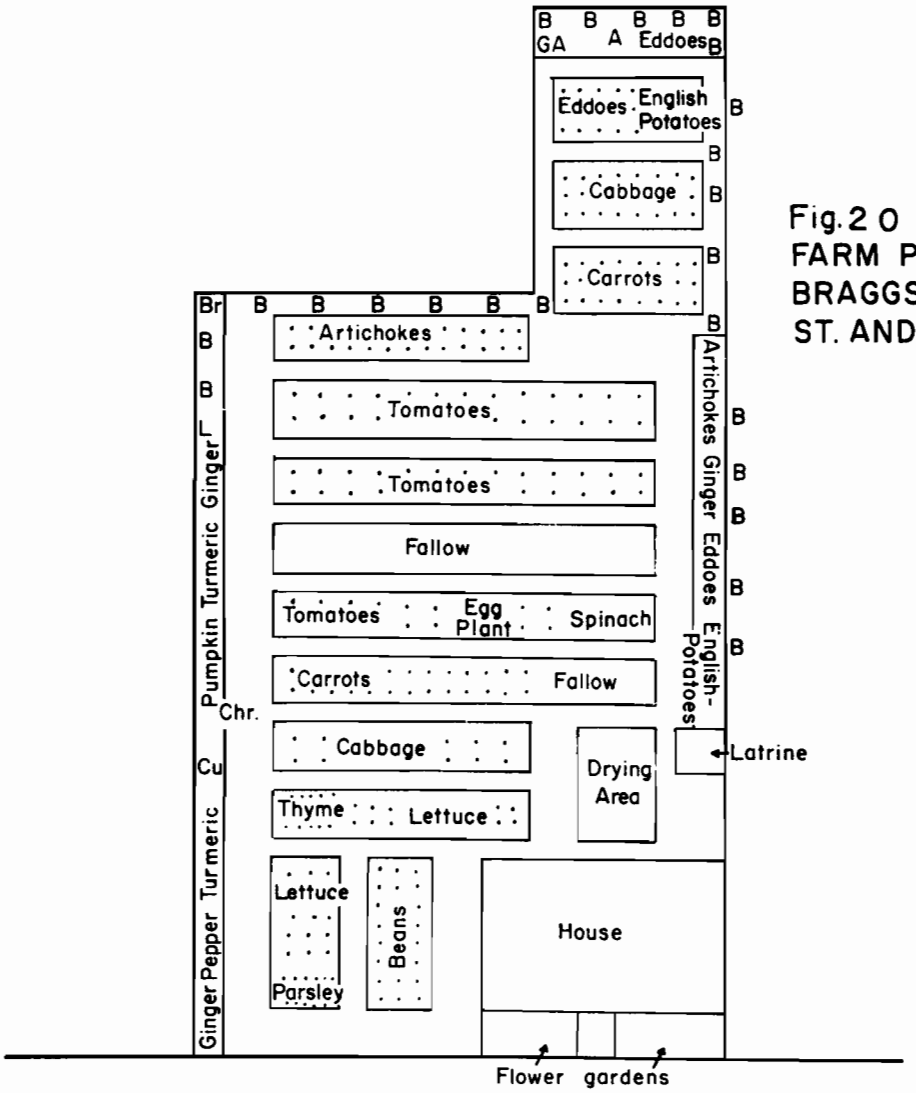


Fig. 2 0
FARM PLAN
BRAGGS HILL
ST. ANDREW.

new planting system has come into use on a few farms. This is the method of planting crops in beds rather than in holes and it is particularly popular on those farms which concentrate on specialist vegetable production (Figure 20) as it enables variations in spacing according to the needs of the different crops.

A further traditional element in the spatial structure of the crops is the planting of pigeon pea around the edge of the cane field. This was done originally by the plantations to provide food for the slaves whilst economising on land and the practice has been copied by the peasants (Figure 18). Bananas and cassava may also be grown around the cane (Figure 17) forming together the sugar cane association. Most fruit trees, however, tend to be grown near the house because of the danger of praedial larceny but their spacing still reflects the cane hole (Figure 17). Often there is one isolated tree larger than the others under which the stock are tethered to graze (Figure 18). Amongst the fruit trees or even on the edge of the cane field the vines of cucumber and melon may often be found. The minor crops are generally planted near the house for the sake of both convenience and safety. In some cases Kus Kus grass is planted along the road frontage to prevent soil wash and to provide fodder for the stock (Figure 16).

Fig. 21 - Flower garden of peasant farm. Note goat tethered under pawpaw tree.

As can be seen from the farm plans and the photograph (Figure 21) the vast majority of farms have a flower garden despite the shortage of agricultural land throughout the island. The uniformity of neat chattel house fronted by bright flower garden gives a distinctive pattern to areas of peasant agriculture wherever they occur on Barbados.

FIGURE 22

PRESENCE LIST OF CROPS FOUND ON PEASANT FARMS IN BARBADOS, 1963

Crop	Number of occurrences	
Cane - pure	142	212
Cane + fruit	38	
Cane + food	25	
Cane + vegetables	7	
Pigeon Pea	107	
Cucumber	65	
Okra	64	
Beans	58	
Pumpkin	53	
Carrot	51	
Cabbage	40	
Eschalot	38	
Tomato	37	
Lettuce	24	
Beet	15	
Cowpea	11	
Egg Plant	10	
Squash	10	
Vegetable Marrow	4	
English Potato	2	
Sorrel	2	
Spinach	2	
Artichoke	1	
Broccoli	1	
Cauliflower	1	
Leek	1	
Melon	1	
Sprout	1	
Pepper	42	
Thyme	42	
Parsley	30	
Turmeric	28	
Majoram	19	
Horseradish	16	
Bay	1	
Mint	1	

Crop	Number of occurrences	
Yam - Lisbon	75	92
Yam - Horn	8	
Yam - Oriental	6	
Yam - Crop	3	
Maize	72	
Sweet Potato	60	
Cassava	56	
Eddo	50	
Ginger	6	
Groundnut	4	
Banana-Cavendish	143	186
Banana-Fig	17	
Banana-Lacatan	10	
Banana-Dwarf	8	
Banana-Gros Michel	8	
Citrus-Lime	99	146
Citrus-Orange	24	
Citrus-Lemon	14	
Citrus-Grapefruit	9	
Breadfruit	132	
Coconut	127	
Pear	121	
Mango	118	
Pawpaw	89	
Soursop	66	
Guava	53	
Golden Apple	36	
Plantain	22	
Sugar Apple	15	
Barbados Cherry	9	
Akee (Genip)	7	
Barbados Plum	3	
Tamarind	2	
Almond	1	
Cashew	1	
Pineapple	1	
Pomegranate	1	

Total number of samples - 213

FIGURE 23

PRESENCE LIST OF LIVESTOCK ON PEASANT FARMS IN BARBADOS, 1963

Animal	Number of Occurrences	
Hens	155)	
Ducks	23)	
Turkeys	12)	192
Pigeons	2)	
Guinea Hens	1)	
Pigs	135	
Sheep	97	
Cattle	92	
Mules	82	
Horses	71	
Goats	41	
Donkeys	34	

Total number of samples - 213

FIGURE 24

FREQUENCY DISTRIBUTION OF CROPS ON PEASANT FARMS, BARBADOS, 1963.

Class	Class range as a percentage	Crop frequency as a percentage
A	1 - 20	65
B	21 - 40	18
C	41 - 60	9
D	61 - 80	5
E	81 - 100	3
		100

CHAPTER 5

THE ISLAND ECOSYSTEMS

The Presence Lists (Figures 22 and 23) and the Frequency Table (Figure 24) show the wide range of individuals found on the peasant farms in Barbados. It can be seen that only cane and bananas have a frequency greater than 80% whilst more than half the plants lie in the class of lowest frequency. This fact illustrates the over-riding dominance of sugar cane throughout the island. Yet, at the same time, it suggests that the Barbadian farmer has access to and is ready to try unusual vegetables or fruits. Often one man will concentrate on one uncommon type of crop, such as leeks, and in this way obtain a monopoly in the market. Thus we have the one crop mentality combined with great adaptability to variation in minor crops.

Crop and Livestock Associations. The common denominator of almost all the crop and livestock associations is sugar cane. From the Presence List it can be seen that certain other crops, exemplified by bananas, citrus, breadfruit, coconut, mango, pigeon pea and yam, have a high frequency

and may be found on most farms associated with sugar cane. Secondary crop associations may also be recognised from the Presence List. Cabbage, carrot and beans occur together as do lettuce, tomato, eschalot and beet. These associations probably reflect the preference of the hawker with whom the farmer deals. It can be seen from Figure 23 that certain animals also form important elements in the cane association. This is the case with the animals, such as fowls and pigs, for whom grazing does not have to be provided. Fowls are less frequently found associated with the specialist vegetable farms because, as in almost every case they are allowed free range, they are very destructive of crops. Nearly half the farms have cattle and/or sheep whilst goats and donkeys are less common. However animals are found with all the major crop associations although equines are rarely found on farms specialising in vegetables and occur most frequently on the purely sugar cane farm. Pigs are a feature of the vegetable farm whilst sheep and goats are often associated with the presence of a high percentage of food crops.

Land Use. The percentage of land on each farm in sugar cane, vegetables and food crops provides a criterion for an analysis of the island pattern of crops.

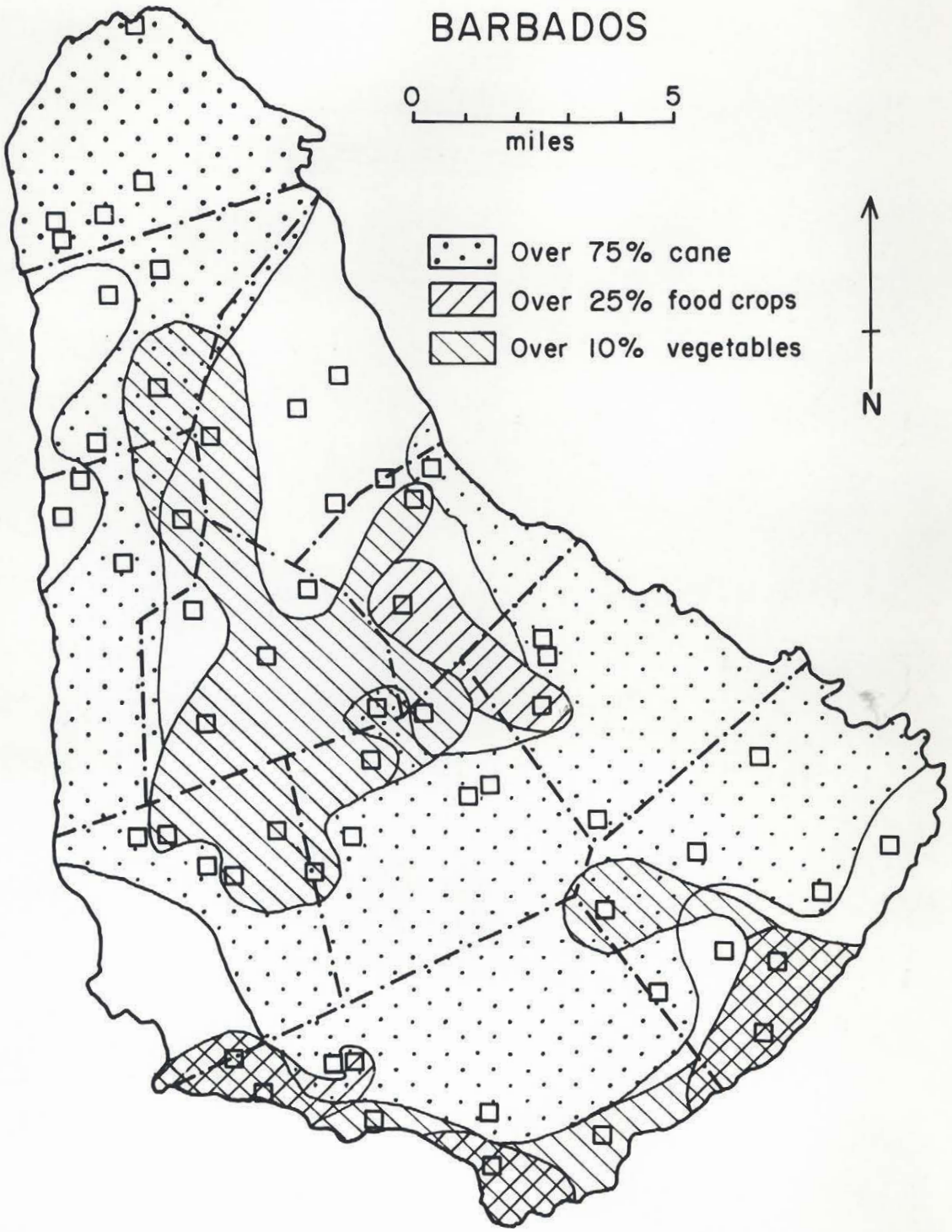


Fig.25 Land Use on Peasant Farms

In Figure 25 isopleths have been drawn to show areal differentiation on the basis of land use. Birch (1954) has pointed out that in using isopleths for mapping discontinuous distributions, such as that of peasant agriculture in Barbados, their values should represent significant changes in distribution. It is suggested that at the level of 75% and under for sugar cane other specialised crops become important. Farms with more than 10% of their area in vegetables or more than 25% in food crops are generally producing these crops for reasons other than home consumption. Sugar cane reaches its greatest dominance in the most isolated areas of gentle relief such as are found in St. Lucy and St. Philip. It can be seen that vegetables attain their greatest importance in the area near Bridgetown or within reach of major transportation routes to Bridgetown. Vegetables also appear to be associated with the high rainfall areas. Where they occur on the south coast the lack of precipitation is compensated for by a large number of wells and the attraction of a market in the high class tourist hotels of this coastal area. Food crops may also be associated with proximity to markets, although it is difficult to explain the isolated occurrences in St. John and St. Joseph. These may be associated with the growing market in the resort areas along

the windward coast. The areas left blank on the map are those in which either fruit trees, as in St. Andrew, or pasture, as in St. Philip, become an important element in the landscape. The urban areas of Bridgetown and Speightstown have also been left blank.

If the three types of land use are plotted against each other (Figure 26), using averages for sample areas, a further grouping can be obtained. The marked clustering at the upper end of the sugar cane base line in the diagram emphasises the monocultural aspects of Barbadian peasant agriculture. Within this cane dominant system there are gradations recognised as groups 1 and 2 in the diagram. The largest group is that with the highest percentage, over 85%, of sugar cane. The second group differs from the first in the replacement of some of the cane by 10 to 35% provisions or food crops but it has even less land under vegetables than the first group. Two groups (3 and 4) may be distinguished in which provisions and vegetables begin to play a relatively important part and farms in these sample areas may be said to form a type of Barbadian mixed farming. The two smallest groups are made up of farms in areas of specialist agriculture. Group 5 has between 40 and 60% vegetables, 5 to 15% provisions and 30 to 55% cane. Group 6 which includes only three sample areas has between 65 and 90% provisions, 10 to 25% vegetables and very little

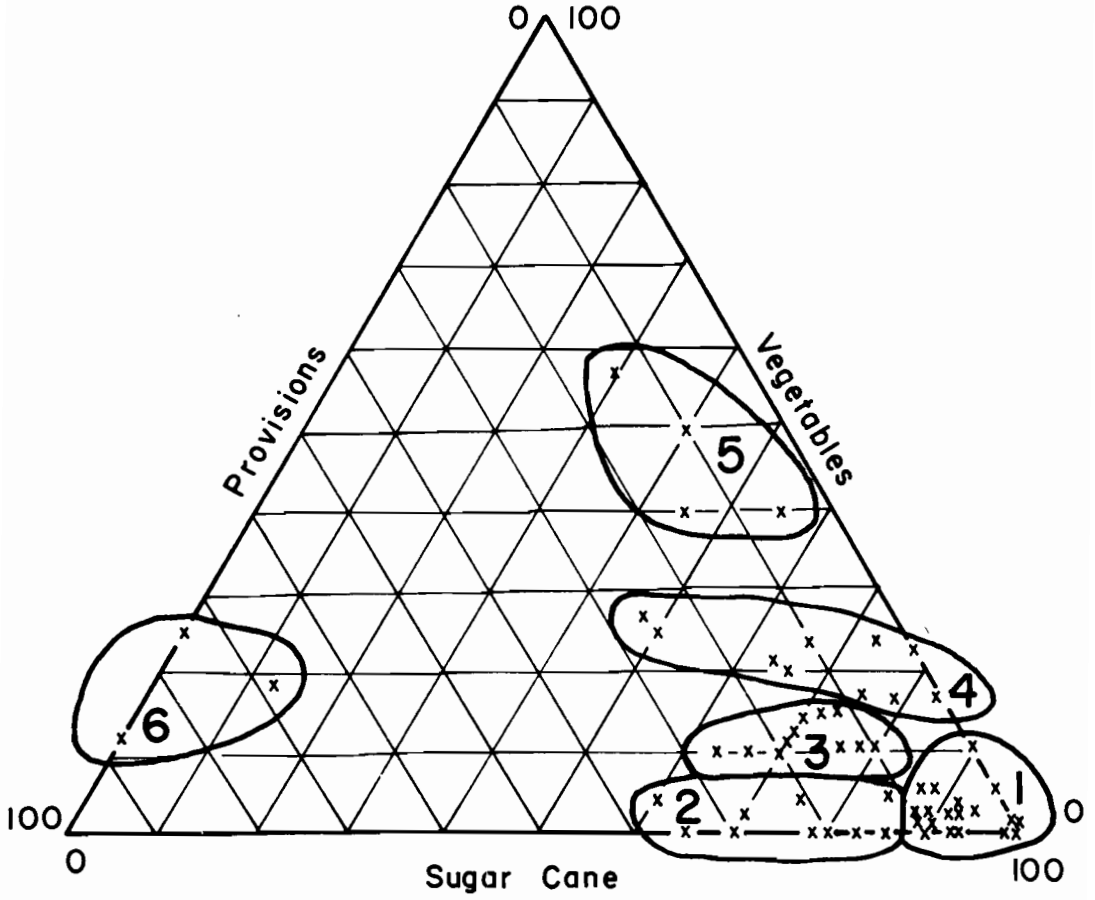


Fig.26 Farming types based on major land use categories

cane. Thus the groups may be classified as follows :-

Group 1 - cane;

Group 2 - cane and provisions;

Group 3 - cane, provisions and minor vegetables;

Group 4 - cane, vegetables and minor provisions;

Group 5 - vegetables;

Group 6 - provisions.

In order to give these theoretical groupings more reality photographs were taken from an airplane flying at a fairly constant height of 500 feet. Traverses were followed across the island from south-east to north-west, and from north-west to north-east over the Scotland District, giving a fairly comprehensive picture of the internal variety of the Barbadian landscape. Figure 27 (a) shows the south-east coast in St. Philip with the first and second cliffs standing out clearly. This is an area of many peasant farms growing mainly sugar cane. The second photograph shows the St. James coast. In this area of hotels and luxurious holiday homes the peasant farmer tends to specialise in crop and livestock production for the nearby market. The next picture shows the typical sugar cane landscape, in this case in St. Thomas, with cane growing pure in the lower portion of the

(a)

(b)

(c)

Fig. 27 - Land use from the air.

(d)

(e)

Fig. 27 - Land use from the air.

photograph and intercropped with fruit trees in the upper portion. The fourth photograph illustrates the abrupt change in the landscape as the Scotland District is approached. The transition from the uniform cane dominated landscape to the more mixed farming of the Scotland District with its fruit specialists can be seen to correlate very closely with the physical landscape. The final picture shows the windward coast of St. Andrew. The steep slopes on which soil slip is a constant problem limiting acreage under cane and the importance of trees in the landscape may be noted.

CHAPTER 6

THE FACTOR ANALYTIC APPROACH

In this chapter and the following two chapters, the elements of peasant agriculture previously described are analysed with a view to obtaining a classification based on both the spatial and internal structure of small farming in Barbados.

The technique used for this breakdown is known as factor analysis. This method of multi-variate analysis attempts to account for the basic matrix[1] of inter-relationships by a minimum, or at least a small number, of hypothetical variates or 'factors'. The chief aim is to achieve scientific parsimony or economy of description whilst maintaining all the essential information of the original set of variables. Harman points out that "while the goal of complete description cannot be reached theoretically it may be approached practically in a limited field of investigation where a relatively small number of variables is considered exhaustive. In all cases, however,

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1 - The mathematics of factor analysis are based upon matrix theory. A matrix may be defined as a rectangular or square arrangement of numbers in a table and a matrix with 'm' rows and 'n' columns is said to be of order 'm' times 'n'.

factor analysis does give a simple interpretation of a given body of data and thus affords a fundamental description of the particular set of variables analysed"[1]. The solutions reached by factor analysis are indeterminate and interpretation must be based on a thorough background knowledge of the problem and on the criterion of utility. Kelley stresses these limitations. "There is no search for timeless, spaceless, populationless truth in factor analysis; rather it represents a simple straightforward problem of description in several dimensions of a definite group functioning in definite manners, and he whom assumes to read more remote verities into the factorial outcome is certainly doomed to disappointment"[2].

To the geographer for whom description is essential, factor analysis can be a very useful tool. When the variables of a study have many complex inter-relationships, as is the case with peasant agriculture, then factor analysis enables one to simplify the problem and to recognise its underlying basic structure. So far most of the work based on factor analysis has been in the field of urban geography and economic development (Berry, 1961 and Gould, 1962) especially in

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1 - Harman, Harry H. Modern Factor Analysis. University of Chicago Press. Chicago, Illinois. 1960. p. 5.

2 - Kelley, T.L. "Comment on Wilson and Worcester's 'Note on Factor Analysis'". Psychometrika. Vol. 5. 1940. p. 120.

"Essays on Geography and Economic Development" and the "Atlas of Economic Development" both edited by Ginsberg (1960 and 1961). Little attempt has been made to study the technique in its relationship to the concepts of geographic methodology. Hartshorne in his discourse on methods of regional geography states that recognition of "patterns of covariance of area"[1] must be based on the element-complex. This he defines as "an elementary integration of two or more dissimilar elements closely dependent on one another"[2], which may be formed from "the widest range of categories, inorganic, organic and social"[3]. "The test of the validity of the complex as an integration is to observe whether its elements in variation through area demonstrate a close inter-relationship"[4]. The theoretical factors of factor analysis satisfy Hartshorne's conditions and offer a form of quantitative element-complex which in some cases may allow greater exactitude and understanding of geographical problems.

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1 - Hartshorne, R. Perspective on the Nature of Geography. London. 1960. p. 120.

2 - Ibid. p. 123.

3 - Ibid.

4 - Ibid. p. 126.

As noted earlier, factor analysis attempts to summarise a large set of intercorrelations among a number of variables in terms of a limited number of factors. The analysis begins with the table of correlation coefficients among the original variables. The factors which are subsequently identified are merely linear combinations of these original variables, with each factor in turn accounting for as much of the original variation among the individual observations as is possible. Since each factor is a combination of the old variables, a factor score can be obtained on each factor for each observation or in terms of the present study, each farm. The correlations between the sets of these factor scores and the original variables are termed the factor loadings and it is possible to obtain a matrix of these loadings which will consist of 'm' rows and 'r' columns where 'm' is the number of original variables and 'r' is the number of factors. Such a matrix is known as a factor structure. The preceding analysis in which the set of 'm' variables is collapsed into 'r' factors is called a 'R' mode factor analysis and is represented in the first problem by the factor pattern of the crops and animals. It is apparent that it is quite possible to run a factor analysis not only on the set of variables but also on the set of observations or farms. In this case a matrix of correlation

coefficients of order 'n' times 'n', where 'n' is the number of cases or observations, provides the starting point and again a set of 'r' factors, each of which now represents a farm complex type, is identified. Factor loadings can be obtained as mentioned earlier. This type of analysis is known as 'Q' mode factor analysis. In the present study, the 'Q' mode analysis enables the set of 150 farms to be collapsed into 4 basic factor types.

For a given matrix of correlation coefficients the position of the reference axes, or reference factors, is indeterminate. In order to achieve a solution which is as meaningful as possible and has consistency from analysis to analysis the reference axes are usually rotated so that they lie at right angles, in other words orthogonal, to each other and are therefore uncorrelated. In the present analysis, the 'R' mode axes were rotated but the 'Q' mode analysis involving the 150 farms was too large to be rotated given the limitations of the Chicago computer programme on which the analysis had to be performed[1]. However, the unrotated solution did allow for a meaningful interpretation to be made of the factor loadings.

Both of the factor analytic solutions, the 'R' and 'Q' modes, yield factor loadings for every variable. In the 'R'

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1 - The Chicago programme was used because it was the only one suitable for a data matrix consisting of ones and zeros and time was not available to design a specific programme for this study.

mode case the variables are the crops while in the 'Q' mode they represent the farms. On the basis of this factor structure it is possible to rank the variables according to the magnitude of their correlations with any one factor. For the crop variables this ranking serves to identify the particular crops which load highest on each factor. These might be thought of as basic peasant cropping combinations for Barbados. The 'Q' mode analysis on the other hand, allows for a ranking of farms on the basis of their correlations with the factors, the farm complex types. The farms which rank particularly high or low on any one factor might be mapped and some interesting spatial associations might thus be revealed.

Other possibilities include quantitative measurements of differentiation between geographic areas in relation to the same basic variables or with regard to the same area at different periods of time. However these are future possibilities and for the time being attention is focussed on the static characteristics of peasant agriculture in Barbados. In the following chapter the question of the crop and livestock patterns on the peasant farms is analysed in terms of the factor analysis outlined in this chapter. Then in Chapter 8 a more general analysis of peasant agriculture is attempted using the same technique.

CHAPTER 7

TYPES OF PEASANT AGRICULTURE IN BARBADOS

Although, as Shephard notes "Peasant agriculturists have imitated, for the most part, the practices prevalent on estates; and there has been no attempt to evolve a system of agriculture suited to the resources and circumstances of the small holder"[1], it has been possible to recognise for at least the last 35 years in Barbados various farming types within the general structure of peasant agriculture.

Skeete (1930), Halcrow and Cave (1947) and Morrison (1951) noted four types: Peasant Cane Farmer; Vegetable Specialist; Dairy Specialist; Mixed Cultivator. They all stressed that there is no rigid dividing line between these four types, hence on any one holding may be found a combination of two of them, though by and large one of the four main types is the predominating enterprise on any one holding. In addition to the above Morrison (1951) mentions a fifth type, the Fruit Specialist.

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1 - Shephard. Op. cit. p. 17.

Peasant Cane Farmer. This was described by Skeete (1930) as the predominating type. For these farmers the cultivation of sugar cane is the main enterprise with some food crops especially on 'thrown out' land, that is land resting between cane crops, and a few fruit trees and small stock.

Vegetable Specialist. On these farms vegetables form the cash crop though generally some land is under food crops and fruit trees whilst small stock rearing especially of goats and pigs is a useful complement. However some of these farms are distinguished by the absence of animals. Where the farm consists of more than one parcel, that piece of land furthest from the housespot is often kept under sugar cane.

Dairy Specialist. These farms are concentrated around Bridgetown and in the vicinity of the main tourist hotels. Land is scarce and costly so the animals are generally stall fed. The difficulty of obtaining sufficient fodder at a reasonable price and the higher standards of hygiene and presentation now demanded by the market are driving this type of peasant farmer out of existence. Much of this type of farming is now in the hands of men with more capital than the average peasant. Poultry farming shows an even more marked tendency to become concentrated in the hands of a few major firms.

The Mixed Cultivator. This group as described by Halcrow and Cave (1947) is also becoming smaller. It is located mainly in the drier, less accessible areas and depends on annual crops for much of its cash income. These crops may be groundnuts, cotton, tobacco, maize or certain vegetables such as eschalot. The mixed cultivator may also rear sheep, goats and pigs for market.

The Fruit Specialist. This type of farmer is found mainly in the Scotland District where cultivation of the steep slopes in cane is difficult. The Barbados Government is encouraging this group and is trying to improve the quality and type of the product so that it will be suitable for export. The main problem seems to lie in the picking and marketing of the fruit as the intermittent labour demand is difficult to satisfy.

Starkey (1939) bases his types of peasant agriculture on soil regions. He noted in particular the annual crops cultivator, found in both the northern and southern black soil districts, who specialises in cotton and guinea corn. In the latter area he mentions the market orientation of the peasant farmer.

In the present study it was postulated that a major change had taken place since Halcrow and Cave defined farming types in

1947. It was felt that some types of crop-livestock association could no longer be recognised whilst others had become important in response to changing economic circumstances. It was hoped also to test the inter-relationships between the different types and to recognise the most common combinations of crop-livestock associations. To this end factor analysis was utilised.

The basic information for this first problem concerned the presence or absence of individual crops or animals on the sample farms. The associated patterns were expressed numerically simply in terms of a data matrix consisting of ones and zeros. The variables were those given in the 'Presence Lists' (Figure 22 and Figure 23) reduced, to simplify the problem, from an original 80 variables to 48. Varieties were grouped together and species with two or less occurrences (under 1% frequency) were omitted. Furthermore, the number of farms was reduced from 213 to 150 by excluding all farms with fewer than ten of the variables present. In this way a matrix with too many zeros was avoided.

The factor structure is given first for the 'R' mode analysis (Figure 28). The loadings involving the 48 primary variables are used to explain and name the factors. The first factor is a general factor whilst the second, third and fourth factors are group factors. Thus the analysis may be said to

approximate Holzinger's Bi-Factor Solution (Harman, 1960).

The variable loading highest on the general factor is bananas followed closely by coconut, breadfruit, mango, pear, sugar cane and fowls. These variables form the components of the basic association underlying most Barbadian peasant agriculture. Sugar cane has its highest loading on this factor, as does pigeon pea because of its traditional association with cane in the cropping pattern. This factor could be described as the Cane-Fruit Association. The group of variables loading highest on Factor 2 is made up of the vegetables and seasonings led by eschalot, thyme, lettuce, parsley, marjoram, pepper, cabbage and carrot. The vegetables loading highest on Factor 2 are those grown for the market, such as eschalot, rather than those grown for home consumption such as okra, and it seems reasonable to associate this second factor with the Cash-Vegetable farming type. Factor 3 loads highest on the food crops especially maize, yam and sweet potato and also has quite a high loading of livestock particularly sheep, goats and equines. In addition, this factor has the highest coefficient for groundnuts, the only annual crop of any importance in the sample. Thus Factor 3 could well be called the Subsistence-Food Crop factor. The fourth factor is of minor importance accounting for only 3.9% of the total

FIGURE 28

ROTATED VARIMAX SOLUTION FOR 48 VARIABLES - 'R' MODE ANALYSIS

Major Groupings of Variables	Variables	Factor 1 Cane-Fruit	Factor 2 Cash-Vegetable	Factor 3 Subsis-tence Food Crop	Factor 4 Rare Fruit Trees
Sugar Cane	Sugar Cane	0.77	0.34	0.33	0.07
Vegetables	Cabbage	0.30	0.61	0.07	0.16
	Carrot	0.35	0.61	0.09	0.16
	Cucumber	0.42	0.42	0.34	0.09
	Cowpea	0.10	0.38	0.08	-0.04
	Pigeon Pea	0.59	0.37	0.30	0.09
	Beans	0.36	0.55	0.19	0.07
	Egg Plant	0.15	0.21	0.05	-0.03
	Okra	0.42	0.48	0.27	0.02
	Pumpkin-squash	0.28	0.47	0.28	0.13
	Eschalot	0.14	0.98	0.05	0.12
	Lettuce	0.12	0.69	0.06	0.00
	Tomato	0.25	0.54	0.19	0.07
	Beet	0.17	0.29	0.16	0.10
Seasonings	Horseradish	0.19	0.47	0.07	-0.06
	Marjoram	0.20	0.63	0.15	-0.01
	Parsley	0.16	0.66	0.15	0.15
	Thyme	0.21	0.82	0.12	0.10
	Pepper	0.37	0.61	0.13	-0.05
	Turmeric	0.21	0.53	0.15	0.05
	Ginger	0.32	0.29	-0.01	-0.06
Food Crops	Yam	0.45	0.16	0.52	0.16
	Sweet Potato	0.34	0.18	0.45	0.14
	Maize	0.27	0.24	0.91	0.21
	Cassava	0.40	0.27	0.40	0.16
	Eddo	0.40	0.23	0.34	0.04
	Groundnut	0.11	0.04	0.24	-0.03

FIGURE 28 - Contd.

ROTATED VARIMAX SOLUTION FOR 48 VARIABLES - 'R' MODE ANALYSIS

Major Groupings of Variables	Variables	Factor 1 Cane-Fruit	Factor 2 Cash-Vegetable	Factor 3 Subsis-tence Food Crop	Factor 4 Rare Fruit Trees
Fruit	Plum	0.14	-0.08	0.03	0.49
	Banana	0.90	0.33	0.27	0.10
	Plantain	0.33	0.09	0.08	0.08
	Pear	0.77	0.30	0.23	0.09
	Citrus	0.68	0.24	0.23	0.16
	Coconut	0.80	0.27	0.23	0.14
	Breadfruit	0.78	0.29	0.23	0.06
	Guava	0.61	0.15	0.07	0.10
	Mango	0.77	0.27	0.20	0.04
	Pawpaw	0.61	0.30	0.20	0.15
	Soursop	0.55	o.27	0.16	0.16
	Golden Apple	0.37	0.18	0.08	0.19
	Sugar Apple	0.14	0.05	0.04	0.99
	Barbados Cherry	o.02	0.03	0.22	0.23
	Barbados Akee	0.12	0.13	0.07	0.31
Livestock	Cattle	0.58	0.23	0.26	0.03
	Sheep	0.53	0.21	0.34	0.14
	Goats	0.31	0.20	0.34	-0.02
	Pigs	0.68	0.34	0.21	0.08
	Equines	0.25	0.09	0.33	0.01
	Fowls	0.72	0.32	0.30	0.16
Eigenvalues		9.84	7.73	3.33	1.87
Cumulative Percentage of Total Variation		20.50	36.60	43.54	47.43

FIGURE 29

UNROTATED 'Q' MODE ANALYSIS FACTOR STRUCTURE

Parish	Sample Area	Farm Number	Factor 1	Factor 2	Factor 3	Factor 4
Christ Church	1	1	0.62	0.27	0.42	0.11
		2	0.28	0.49	-0.01	0.46
	2	3	0.76	0.10	0.21	0.13
		4	0.71	0.26	0.20	-0.14
	3	5	0.56	0.51	0.29	0.11
		6	0.19	0.62	0.04	-0.09
	4	7	0.35	0.49	0.41	0.38
		8	0.55	0.45	-0.07	-0.08
	5	9	0.64	0.31	0.22	0.35
	6	10	0.85	0.05	0.15	-0.06
		11	0.72	0.10	0.18	-0.14
	7	12	0.24	0.42	0.13	0.15
		13	0.64	0.45	0.13	-0.05
St. Philip	8	14	0.43	0.21	-0.05	00.00
		15	0.63	0.52	0.09	0.27
		16	0.24	0.49	0.20	0.46
		17	0.30	0.47	0.13	0.40
	9	18	0.80	0.04	0.18	0.11
	10	19	0.53	0.20	0.21	0.09
		20	0.76	0.44	0.21	0.07
		21	0.73	0.25	-0.03	0.21
	11	22	0.48	0.49	-0.15	0.07
		23	0.79	0.10	0.22	0.03
		24	0.58	0.31	0.45	0.08
		25	0.48	0.32	0.11	0.20
		26	0.55	0.16	0.24	0.18

FIGURE 29 - Contd.

UNROTATED 'Q' MODE ANALYSIS FACTOR STRUCTURE

Parish	Sample Area	Farm Number	Factor 1	Factor 2	Factor 3	Factor 4
St. Philip	12	27	0.55	0.15	-0.13	0.05
		28	0.72	0.16	0.25	0.25
	13	29	0.32	0.35	0.10	0.36
		30	0.67	0.53	-0.22	0.06
	15	31	0.71	0.24	0.05	0.02
		32	0.58	0.28	-0.00	0.10
	16	33	0.50	0.35	0.02	0.04
Christ Church	17	34	0.48	0.44	0.05	-0.01
St. Michael	18	35	0.56	0.55	-0.18	0.08
		36	0.39	0.46	0.16	0.24
	19	37	0.48	0.26	0.24	-0.17
		38	0.25	0.55	-0.07	0.19
	20	39	0.73	0.04	0.15	-0.04
		40	0.56	0.32	0.01	0.13
	21	41	0.65	0.55	-0.19	0.09
		42	0.69	0.54	-0.09	-0.02
	22	43	0.62	0.27	0.23	0.23
		44	0.41	0.42	-0.07	-0.05
St. George	23	45	0.63	0.78	0	0
		46	0.67	0.45	-0.11	-0.05
	24	47	0.65	0.29	0.07	0.12
	25	48	0.65	0.24	0.10	-0.12
		49	0.67	0.45	-0.11	0.02

FIGURE 29 - Contd.

UNROTATED 'Q' MODE ANALYSIS FACTOR STRUCTURE

Parish	Sample Area	Farm Number	Factor 1	Factor 2	Factor 3	Factor 4
St. George	26	50	0.68	0.26	0.27	-0.05
		51	0.61	0.44	-0.20	0.05
		52	0.73	0.21	0.05	-0.01
		53	0.67	0.23	-0.03	-0.05
	27	54	0.62	0.15	0.29	0.18
		55	0.39	0.36	0.15	0.31
	28	56	0.60	0.50	0.01	0.02
		57	0.55	0.16	0.24	0.07
St. John	29	58	0.69	0.22	0.30	0.01
		59	0.48	0.64	-0.00	0.03
	30	60	0.64	0.25	0.25	-0.01
	32	61	0.75	-0.02	0.16	0.13
St. James	33	62	0.45	0.35	0.43	0.03
		63	0.69	0.20	0.13	0.35
		64	0.79	0.04	0.13	0.12
	34	65	0.38	0.50	0.12	0.12
		66	0.73	0.19	0.42	0.01
		67	0.47	0.30	-0.10	0.21
		68	0.87	0.05	0.22	-0.03
		69	0.69	0.25	0.28	0.13
	35	70	0.47	0.37	0.45	0.33
		71	0.62	0.27	0.42	0.21
	36	72	0.48	0.49	-0.23	0.08
		73	0.60	0.59	0.04	-0.18

FIGURE 29 - Contd.

UNROTATED 'Q' MODE ANALYSIS FACTOR STRUCTURE

Parish	Sample Area	Farm Number	Factor 1	Factor 2	Factor 3	Factor 4
St. Thomas	37	74	0.47	0.53	0.15	0.02
		75	0.48	0.38	-0.21	-0.00
		76	0.57	0.55	-0.16	-0.04
		77	0.32	0.57	-0.39	0.19
	38	78	0.53	0.31	0.43	0.02
		79	0.60	0.20	0.53	-0.08
		80	0.71	-0.03	0.23	0.06
		81	0.40	0.61	-0.26	0.22
		82	0.47	0.63	-0.13	0.04
		83	0.83	0.04	0.19	0.12
	39	84	0.46	0.63	-0.15	-0.06
		85	0.57	0.42	0.03	-0.08
		86	0.56	0.51	-0.09	0.01
	40	87	0.63	0.35	0.08	0.07
		88	0.71	0.20	0.05	-0.01
		89	0.60	0.54	0.06	0.10
		90	0.73	0.42	-0.26	0.02
	41	91	0.62	0.27	0.23	0.23
		92	0.49	0.45	-0.03	-0.14
		93	0.23	0.60	-0.36	0.08
		94	0.80	0.10	0.06	0.10
St. Joseph	42	95	0.67	0.32	0.23	-0.03
		96	0.63	0.28	0.23	0.02
		97	0.61	0.37	-0.07	0.09
		98	0.90	-0.01	0.11	-0.03
		99	0.79	0.15	0.06	0.03
	43	100	0.71	0.20	-0.04	0.10
		101	0.79	0.15	0.23	0.11

FIGURE 29 - Contd.

UNROTATED 'Q' MODE ANALYSIS FACTOR STRUCTURE

Parish	Sample Area	Farm Number	Factor 1	Factor 2	Factor 3	Factor 4
St. Andrew	45	102	0.71	0.32	0.10	-0.05
		103	0.82	0.20	-0.10	0.17
		104	0.84	0.04	0.04	0.08
		105	0.93	-0.01	-0.02	0.08
	46	106	0.69	0.20	0.39	-0.04
		107	0.58	0.15	0.26	-0.09
		108	0.79	-0.03	0.27	-0.22
		109	0.90	-0.01	0.07	0.11
		110	1.00	0	0	0
		111	0.94	0.10	-0.06	0.05
		112	0.94	0.05	-0.03	-0.02
	47	113	0.62	0.21	0.07	0.17
		114	0.73	0.15	0.27	-0.00
		115	0.97	0.05	0.06	-0.03
		116	0.88	0.10	0.15	-0.02
		117	0.73	0.19	0.08	0.22
	48	118	0.84	0.04	-0.05	0.09
		119	0.80	0.04	-0.00	0.23
		120	0.85	0.10	0.12	0.01
	49	121	0.56	0.66	-0.03	0.03
		122	0.43	0.39	0.34	0.09
St. Peter	50	123	0.50	0.27	0.25	0.22
		124	0.71	0.11	0.26	0.00
	51	125	0.63	0.38	-0.15	-0.16
		126	0.39	0.69	-0.08	0.00
		127	0.43	0.39	-0.26	0.05
	52	128	0.67	0.53	0.05	-0.13
		129	0.63	0.17	0.51	-0.00
		130	0.50	0.27	0.15	-0.20

FIGURE 29 - Contd.

UNROTATED 'Q' MODE ANALYSIS FACTOR STRUCTURE

Parish	Sample Area	Farm Number	Factor 1	Factor 2	Factor 3	Factor 4
St. Peter	53	131	0.56	0.40	0.72	0
		132	0.68	0.17	0.42	0.18
		133	0.63	0.17	0.07	-0.08
St. Lucy	54	134	0.73	0.25	0.30	0.27
		135	0.73	0.21	0.24	0.27
		136	0.69	0.30	0.16	0.21
	55	137	0.56	0.51	0.20	0.21
		138	0.57	0.42	0.11	0.25
	56	139	0.58	0.25	0.12	0.23
		140	0.50	0.49	-0.16	-0.13
		141	0.45	0.35	0.08	0.82
		142	0.73	0.21	0.14	0.38
	57	143	0.55	0.65	0.03	0.02
		144	0.64	0.25	0.16	0.28
		145	0.62	0.27	0.42	0.11
		146	0.40	0.48	-0.12	0.18
	58	147	0.47	0.42	0.23	0.52
		148	0.53	0.29	-0.15	0.49
		149	0.53	0.31	0.15	0.44
		150	0.45	0.28	0.01	0.63
Eigenvalues			60.19	19.32	6.82	5.30
Cumulative Percentage of Total Variation			40.01	53.00	57.55	61.08

variation in crop combinations. It appears to be mainly a special fruit tree combination, loading highest on the rare trees and being the only factor with a markedly low loading of sugar cane.

The second matrix (Figure 29) shows the loading of individual farms on the factors resulting from the 'Q' mode analysis. The crop-livestock combinations on the farms loading high on the first four factors, which account for 61% of the total variation, are those recognised by the 'R' mode analysis. The general nature of the first factor is emphasised by the fact that the majority of farms load high on it, one farm indeed reaching unity, and there being no negative loadings. This factor accounts for 40% of the original variation of the farms over the total crop-livestock pattern. Factor 2 accounts for 13% of the variation and its negative loadings are found mainly in the Scotland District, the area with the highest loadings on the first factor. Factor 3 explains only 4.5% of the variation. The geographical distribution of this factor is not so clearly marked as on the previous two factors: loadings are highest in the parishes of St. Peter and St. Thomas but these parishes also have the highest negative loadings. This mixture of high negative and positive coefficients is also found at the sample area level. At the level of the individual farm causal relationships are probably micro-geographic in nature. The reaction of the farmers to marginal economic influences, inertia and a stochastic

element may also be postulated. The fourth factor accounts for even less of the total variation, 3.5%, but it does have a strong geographical pattern with its highest loadings concentrated in the parish of St. Lucy. This emphasises the distinctive characteristics of this parish occasioned by its isolation from the rest of the island. It is suggested that this prominence of St. Lucy is based on the presence of certain rare fruit trees such as sugar apple, Barbados Akee and cherry, grown for home consumption rather than for the market. This can lead us to the generalisation that peasant agriculture in St. Lucy is more markedly of a subsistence nature than small farming elsewhere in the island.

The results of the 'R' and 'Q' mode analyses may be used to test the following hypotheses :-

(a) that the sugar cane monoculture of the plantations is imitated by the peasant farmers;

(b) that there are fewer recognisable crop-livestock combinations today than when Halcrow and Cave surveyed peasant agriculture;

(c) that the metropolis exerts an influence on the surrounding area of peasant agriculture;

(d) that certain districts of Barbados are characterised by specific types of crop-livestock association.

The first hypothesis is supported to a certain degree by the results of the 'R' mode analysis. As can be seen (Figure 28) sugar cane is a very important element in the three main crop-livestock associations represented by the first three factors. It also has a high communality. Yet the peasant rarely depends on cane for his total farm income. He usually grows food and vegetable crops and fruit trees and keeps small stock basically for his own consumption but any excess production is sold to a hawker. The 'mixed - farm' aspect of the Cane-Fruit Association has generally been ignored by previous writers. In his approach to self-sufficiency can be seen the influence of the traditional slave provision grounds on the plantation.

The factor structure of the 'R' mode analysis would seem to support the second hypothesis. The strong general factor indicates that some crop combinations recognised in the field by earlier workers are today merely minor variations of the basic association of crops and livestock. The size of the vegetable factor suggests that this Cash-Vegetable type is the major variant whilst the Mixed Farm Cultivator with annual crops who may be associated with Factor 3 is seen to be less important than he was apparently twenty years ago.

Figure 30 illustrates the third and fourth hypotheses. The influence of the metropolis on land use would be expected to

take the form of increased market orientation of crop production. It can be seen that farms specialising in commercial production of vegetables do tend to cluster around Bridgetown extending outwards along the major traffic arteries, with a secondary concentration around Speightstown, the only other urban centre of any significance on the island.

The 'Q' mode factor structure (Figure 29) with its geographical groupings of high loadings (the distribution of high loadings on Factor 1 and Factor 2 is shown in Figure 30) upholds the fourth hypothesis. Two distinctive districts stand out: firstly the Scotland District with its high loadings on the first factor and low on the second, and secondly the Bridgetown District with its high loadings on Factor 2 and low on Factor 1. In addition, a grouping of the farms in the northernmost parishes of St. Peter and St. Lucy, with low loadings on the first factor and average on the second, may be distinguished.

In conclusion it may be said that the results of the factor analysis have, in general, supported the hypotheses which were suggested by the fieldwork. But the analysis has also presented new aspects of the distribution of crop-livestock associations that had not emerged from previous qualitative discussions. The size of the general factor stresses

the basic similarities underlying the crop and animal combinations found in different parts of Barbados. From this factor it is possible to develop a ranking of farms according to their variation from the 'typical farm' as measured by the size of the loadings. As a corollary, the results suggest that, with the single exception of the Cash-Vegetable type other associations are of little significance when the island pattern is considered in toto. The factor loadings provide a basis for a regional division of farming types and the causal relationships underlying this distribution will be discussed in the following chapter.

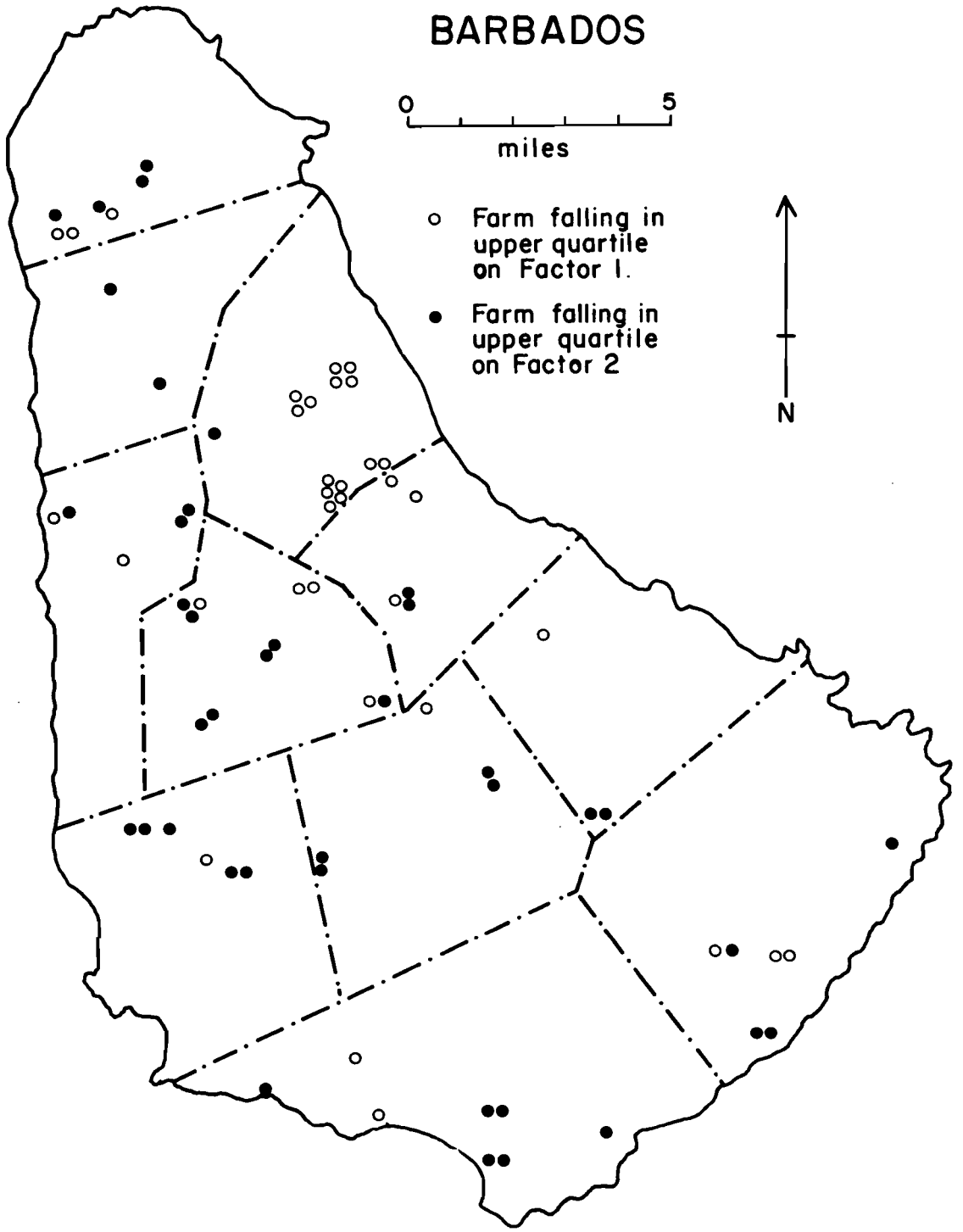

Fig.30Distribution by farms on Factor I and Factor 2

CHAPTER 8

THE INTERNAL STRUCTURE OF PEASANT AGRICULTURE

The second problem submitted to factor analysis had as its basic measures 32 variables covering a wide range of information for 116 peasant farms (Figure 31). The choice of these measures was based on previous knowledge of the problem and fieldwork. Underlying this choice was the hypothesis that these variables were responsible for the structural variation in peasant agriculture in Barbados. It was hoped that factor analysis would present a simplified description of this structure and that the factors identified might have some relevance for studies of peasant agriculture in other areas.

The results of the factor analysis are only as good as the choice of primary variables. A consideration of the matrix of correlation coefficients (Appendix C, Figure 34) provides us with a descriptive analysis of these basic measures. Some of the relationships between pairs of variables are fairly straightforward whilst others are very subtle

FIGURE 31

VARIABLES FOR 'R' MODE ANALYSIS PROBLEM 2

Variable		Mean	Standard Deviation
1.	Acreage of farm	0.21	0.34
2.	Number of parcels making up holding	1.73	1.00
3.	Distance of furthest parcel from housespot	0.04	0.10
4.	Land rented out or not	0.18	0.39
5.	Price per acre (in West Indian dollars)	3,613	1,283
6.	Percentage of land in sugar cane	68.47	29.40
7.	Percentage of land in vegetables	10.92	18.87
8.	Percentage of land in food crops	16.26	21.45
9.	Percentage of land in pasture	4.76	12.68
10.	Percentage of land in trees	3.13	9.86
11.	Number of animal units[1]	0.14	0.19
12.	Distance of farm from Bridgetown in miles	8.70	4.00
13.	Number of labourers hired	2.45	2.35
14.	Days per week worked by farmer off farm	3.18	2.14

1 - The selection of animal units was based on the system of weighting used by the Food and Agriculture Organisation of the United Nations in its 1962 Production Yearbook.

FIGURE 31 - Contd.

Variable	Mean	Standard Deviation
15. Size of farm family	5.20	3.33
16. Number of children under 15 years	2.10	2.54
17. Number of women	2.79	1.87
18. Tenure - freehold or not	0.65	0.48
19. Mechanisation - used or not	0.54	0.50
20. Water supply - near pipe or not	0.93	0.25
21. Fertiliser - used or not	0.95	0.22
22. Transportation - means owned by farmer or not	0.34	0.48
23. Soil type - fertile or not	0.53	0.50
24. Slope - gentle or steep	0.77	0.42
25. Depth of soil - deep or shallow	0.45	0.50
26. Stoniness - little or excessive	0.64	0.48
27. Erosion - absent or present	0.73	0.44
28. Farming efficiency - high or low	0.59	0.49
29. Woman's role - farmer or not	0.29	0.46
30. Attitude to farming - interested or not	0.49	0.50
31. Family abroad - yes or no	0.55	0.50
32. Level of education - secondary or not	0.61	0.49

depending on the relationships of both variables with other variables. It is apparent that some variables are so highly intercorrelated that they might have been omitted from the analysis on this ground alone. For example, the variables concerning population structure, that is to say the number of women, and the number of children under 15 years of age, are closely related to the level of total population, and it would appear that any future study would be little affected by their exclusion.

On the whole, the correlation matrix contains very few high coefficients, with only 5 out of a total of 528 values being equal to or greater than the absolute value of .5. Excluding the population variables, the three remaining high correlation coefficients are associated with the following relationships

Area rented out / Number of animal units (negative)

Price of land per acre / Percentage of land in sugar cane (negative)

Percentage of land in food crops / Percentage of land in trees (positive)

The first coefficient is largely a reflection of the association of both variables to other variables such as total farm acreage and distance from Bridgetown. The second

negative coefficient might be indicative of the fact that sugar cane yields a lower rent per acre and therefore cannot be grown when land prices are high but this negative correlation might also stem from the close association of both these variables with the factor of distance from Bridgetown. The third coefficient is partly due to the technical inter-dependence of the various land uses and partly to the influence of soil variables on both crop variables. The low values of most of the correlation coefficients in the matrix are suggestive of the diversity of peasant agriculture in Barbados. However, the relationships between the variables are generally too complex to be shown by simple correlation analysis and factor analysis was used to provide greater understanding of these inter-relationships.

In this problem, only the 'R' mode factor analysis was carried out[1]. It was felt that this technique would yield a meaningful interpretation of the primary variables and their relationship to the underlying basic structure of Barbadian peasant agriculture. It was found that the 32 variables could be collapsed to form 12 new independent variates or factors which together account for the total variation between the 116 farms which was apparent on the primary variables. The first

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1 - See page 76.

four factors account for over half of this variation and the first six for 68% of it. The complete matrix of correlation coefficients or factor loadings between the 32 variables and the 12 factors is given in Appendix C, Figure 35. For more convenient reading of the results the variables having the highest loadings on the factors have been extracted (Figure 32).

The interpretation of the factors depends on the strength of the relationships between the variables and the factors as shown by the factor loadings. At least three variables with high loadings are needed before a factor can be meaningfully identified[1]. A further difficulty in interpretation is presented by the type of data used in this study. The primary variables are either dichotomous (measured in ones and zeros) or continuous, and when considering their correlation coefficients the sign (negative or positive) has to be interpreted in the most meaningful way based on previous knowledge of the problem.

The first two factors are both associated with distance variables and together account for almost one-third of the total variation. The first factor which accounts for .16%

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1 - According to Fruchter (1954) loadings of .2 or less are usually regarded as insignificant, loadings of .2 to .3 as low, .3 to .5 as moderate, .5 to .7 as high, and above .7 as very high.

FIGURE 32

PRIMARY VARIABLES SHOWING THE HIGHEST CORRELATIONS WITH THE FACTORS

	Factor 1
Distance from Bridgetown	-0.811
Price per acre	0.739
Family Abroad	-0.525
Percentage of land in food crops	0.522
	Factor 2
Distance of furthest parcel from housespot	-0.791
Number of parcels making up holdings	-0.782
Acreage	-0.399
Water supply	0.310
	Factor 3
Size of farm family	0.956
Number of women in family	0.906
Number of children under 15 years	0.905
Family Abroad	0.204
	Factor 4
Attitude to farming	-0.737
Efficiency	-0.727
Fertiliser	-0.294
Education	-0.242
	Factor 5
Percentage of land in sugar cane	0.775
Percentage of land in vegetables	-0.774
Fertiliser	0.554
Percentage of land in trees	-0.334

FIGURE 32 - Contd.

	Factor 6
Percentage of land in pasture	0.845
Number of animal units	0.733
Work off farm	-0.417
Fertiliser	-0.361
	Factor 7
Erosion	-0.864
Slope	-0.568
Depth of soil	-0.554
	Factor 8
Stoniness	0.740
Percentage of land in food crops	-0.517
Depth of soil	0.408
	Factor 9
Number of labourers employed	0.696
Water supply	0.582
Acreage	0.493
	Factor 10
Education	0.735
Transport	0.636
Mechanisation	0.493
	Factor 11
Tenure	0.763
Rented land	0.597
Acreage	0.296
	Factor 12
Percentage of land in trees	0.690
Woman's role	0.673
Slope	-0.447

of the variation relates to the geographical position of the farm with reference to distance from Bridgetown. This first factor recognises urban influence and it is interesting to note the direction of the relationship of the other variables on this factor and to compare these with the relationships found by Tarver (1963) in his study of metropolitan dominance and agriculture in the United States. With Tarver it was found that there was a direct relationship with size of farm and number of women on the farm and an inverse relationship with education, time spent in work off the farm, and with the general standard of living on the farm. However, unlike Tarver's analysis this study did not find a decline in farm tenancy or density of farm population with distance from the city. This difference may perhaps be accounted for by the method of development of peasant agriculture in Barbados, that is to say its dependence on the break-up of plantations, and by the small size of the island. The second factor although it has only two high loadings accounts for .15% of the variation and might be termed a 'fragmentation' factor as it is concerned with the number and location of parcels on the holding. The high value of this factor emphasises the importance of this 'fragmentation' element in the structure of Barbadian peasant agriculture.

The next four factors account for slightly more than one-third of the total variation. The three variables with high loadings on Factor 3 are closely linked and describe the farm population. This factor may be identified as a 'demographic' factor. The fourth factor is, like the second, a doublet, that is it has only two variables loading high on it. These are the two dichotomous variables measuring the personal qualities of the farmer, that is to say his attitude to farming and his efficiency. These variables were based on the appearance of the farm and on the farmer's answers to questions concerning the future of his children and his interest in the land. This factor is identified as a 'motivation' factor. The fifth factor has its highest loadings on three types of land use; sugar cane, vegetables and trees. It also recognises fertiliser which by its positive loading is linked to cane rather than to the other two categories of land use. This is a relationship which has already been noted[1]. Since this factor has the highest coefficients for most of the arable land use categories it is identified as a general 'crop' factor. The sixth factor picks up the pasture land use type with its closely linked livestock and,

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1 - See page 45.

as might be expected, a negative loading on the fertiliser variable. The negative loading for the variable, time spent off the farm in other occupations, would suggest that animals both demand more attention than crops and also reduce the need for outside employment by bringing in a higher return per acre. This is certainly the case with specialist dairy and poultry farms. This factor has been identified as a general 'livestock' factor.

The remaining six factors account for the final third of the total variation and may also be identified as representing basic elements in the structure of peasant agriculture. Factors 7 and 8 are soil factors emphasising in particular erosion and stoniness. Factor 8 also has a high coefficient for food crops. The isolation of this category of land use would suggest that it is influenced by factors other than those governing the general land use pattern. Food crops load highest on Factors 1 and 8 indicating that their distribution is closely linked to distance from Bridgetown and to the stoniness and depth of the soil. Variables with high positive loadings on Factor 9 are the number of labourers employed, water supply and acreage which would suggest that this factor is associated with the more prosperous farms. Factor 10 emphasises education, availability of transport and mechanisation. The variable concerned with work off the farm has its highest

positive loading on this factor. When all the loadings are considered it is recognised as a general 'education' factor. Factor 11 loads highest on variables concerning land tenure. Factor 12 has high positive coefficients for land under trees, and woman's role on the farm and negative loading for slope which would indicate that this factor might be associated with the less prosperous farms particularly in the Scotland District. As the woman's role variable has its highest loading on this factor it has been used to name the factor.

Factors 2, 4, 6, 8, 11 and 12 are less strongly identified than are the other factors as they have only two variables with loadings outside the limits of $\pm$ .5. This high proportion of doublets may be due to a failure to cover all the aspects of the area under investigation adequately with the primary variables.

Figure 33 shows the 12 factors recognised by the 'R' mode analysis with their eigenvalues and percentages of the total variation. It can be seen that although the first four factors are responsible for over one half of the variation the remaining eight factors each contribute a significant amount to the total variation. This would indicate that the primary variables selected have been collapsed into 12 factors which do indeed form meaningful elements of the basic structure

FIGURE 33

IDENTIFICATION OF FACTORS

Factor	Identity	Eigenvalue	Percentage of Total Variance accounted for
1	Urban Influence	3.65	0.16
2	Fragmentation	3.45	0.15
3	Demographic	2.75	0.12
4	Motivation	2.26	0.10
5	Crops	1.73	0.08
6	Livestock	1.58	0.07
7	Erosion	1.32	0.06
8	Stoniness	1.29	0.06
9	Employment	1.24	0.05
10	Education	1.18	0.05
11	Tenure	1.16	0.05
12	Woman's Role	1.03	0.04

of Barbadian peasant agriculture. The order of importance of these factors may be used as an indicator of the area in which development should be concentrated. It has already been noted that most farmers have freehold ownership and are at least literate, and this is supported by the fact that the factors on which the loadings for tenure and education are highest account for only .1% of the total variation. The relatively gentle and easy terrain of the island poses few problems for the farmer and the two factors identified as associated with the physical landscape rank sixth and seventh in order of importance. The primary variables loading highest on these factors are those associated with geology rather than land forms, that is erosion (found mainly in the Scotland District) and stoniness. The factor linked to fragmentation accounts for almost the same proportion of the total variation as does the first factor which is associated with urban influence. This might suggest that peasant agriculture in Barbados would benefit most from a policy of consolidation of holdings and the development of subsidiary centres for marketing and services. The functions of Speightstown, in particular, could be improved to serve the northern part of the island, and in the Scotland District development could be linked with the growth of the tourist trade of the windward coast.

SUMMARY AND CONCLUSIONS

The results of this study indicate that factor analysis provides a valid technique for an interpretation of the basic structure of peasant agriculture in Barbados today. Since the Second World War peasant agricultural development has accelerated, fragmentation has increased and the number of full time farmers has decreased. There has been great improvement in methods, for example better seeds, more use of fertiliser and mechanisation, but little change in the type of farming. Indeed today there seems even less specialisation than noted by previous workers and the sugar cane association dominates peasant agriculture almost to the same degree it does plantation agriculture. It is suggested that the major problems facing peasant agriculture are those resulting from the dominance of Bridgetown and the fragmentation of holdings. In addition some areas, such as the Scotland District and St. Lucy, have their own particular problems which are emphasised by their isolation.

Suggestions for Further Work. The technique of factor analysis used in this study offers possibilities of application elsewhere. Work needs to be done, using factor analysis, on peasant agriculture in other areas in order to increase our understanding of the factors recognised in this study. If these factors appear to be fairly constant and meaningful over a series of analyses then it may be possible to use them as bases for comparison between areas. An area which is known to differ from Barbados in one or more specific aspects may be analysed in order to see what effect is noted on the factor loadings. An example which might well be taken as the first in the projected series of studies might be that of St. Lucia, an island in the Windward Group, lying approximately one hundred miles north-west of Barbados. The environment of peasant agriculture in this island differs from that of Barbados in that the physical landscape is volcanic and the cultural landscape has been influenced by the French from whom the British obtained possession of the island at the end of the eighteenth century. From St. Lucia it would seem logical to turn to Martinique, an island just to the north of the former island, which has a similar physical landscape to that of St. Lucia but culturally is as French as Barbados is British. There are many further possibilities

within the Caribbean. It would be interesting to gain an understanding of the effect on peasant agriculture of the dichotomy of volcanic and coral islands in the area. Then, in addition to French and British cultural influences, the effect of the Dutch and Spanish cultures on small farming might be analysed. Finally it should be possible to apply the technique developed in the West Indies to other parts of the tropics, such as West Africa, and there explore the effect on agriculture of similar variations in physical and cultural landscapes.

It is hoped that this present study will prove seminal not only in its use of factor analysis but also in its field methodology. If any useful comparisons are to be made between peasant agriculture in different parts of the tropics, as outlined above, then these must be done within a limited period of time. This restriction means that rapid methods of data collection must be developed. It should be possible, with the experience gained in this study, to use the results of the 1961 Agricultural Survey of the Food and Agriculture Organisation of the United Nations, in conjunction with short periods of fieldwork, to obtain sufficient material on the primary variables for a useful application of factor analysis.

The results of a series of studies might provide us with the basis for a new index of development as reflected in

peasant agriculture. The ranking of the factors suggests aspects of peasant agriculture on which development programmes could have most effect. Studies made of the same area at different times might give some indication of the direction and effect of change. Thus factor analysis can be a useful tool in our understanding of both the static and dynamic aspects of peasant agriculture.

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APPENDIX A

QUESTIONNAIRE 1

BARBADOS

SAMPLE SURVEY OF PEASANT AGRICULTURE

CONFIDENTIAL - For statistical purposes only

For Office Use Only

Parish _____

Sample Number _____

Farm Number _____

SECTION A

1. Name of farm operator _____
2. Address _____
3. Net farm acreage _____

APPENDIX A - Contd.

For Office Use only

SECTION B

4. In the table below state for each parcel its situation, tenure and acreage

Type of Tenure	Abbreviation
Freehold ownership	O
Rented (a) Cash tenancy	C
(b) Share tenancy	S
(c) Rent free or peppercorn tenancy	RF

Parcel Number	Name of Parcel or Situation	Distance from Housespot	Tenure Type	Acreage
1				
2				
3				
4				
5				
6				

5. Area rented out _____

6. Land value (based on price paid for land recently in neighbourhood) :-

_____

APPENDIX A - Contd.

SECTION C

For Office Use Only

7. Land Utilization: In the table below, show how the Net Acreage of each parcel was utilized over the 12 months previous to enumeration day

	Acreage or Number of Holes	
	For Total Farm Unit	For Area of Farm Within Sample
Area under cane		
Area under vegetables and seasonings		
Area under food crops or provisions (total)		
Area under (i) Yams		
Types of Yams planted (check one or more)		
Lisbon (a)( )		
Horn (b)( )		
Oriental (c)( )		
Crop (Hunt) (d)( )		
(ii) Sweet Potatoes		
Types of Potatoes planted (check one or more)		
Black Rock (a)( )		
White Gilkes (b)( )		
Caroline Lea (c)( )		
(iii) Maize		
(iv) Cassava		
(v) Eddoes, Tantias, Dasheen		
Area under grass		
Area under woodland		
Built on and service area (including housespot)		
TOTAL		

APPENDIX A - Contd.

For Office Use Only

SECTION C

8. Crops Growing at Present: In the table below check crops present on enumeration day. Give total acreage or number of holes of each type of crop.

	For Total Farm Unit	For Areas of Farm Within Sample
(a) Cane: Total acreage or number of holes		
(i) Sugar cane-pure stands		
(ii) Cane with food crops		
(iii) Cane with vegetables		
(iv) Cane with fruit trees		
(b) Vegetables: Total acreage or number of holes		
(i) Cabbage		
(ii) Carrot		
(iii) Cucumber		
(iv) Cowpea or Christophene		
(v) Pigeon Pea		
(vi) Beans		
(vii) Egg Plant		
(viii) Okra		
(ix) Pumpkin		
(x) Squash		
(xi) Vegetable Marrow		
(xii) Eschalot		
(xiii) Lettuce		
(xiv) Tomato		
(c) Seasonings: Total acreage or number of holes		
(i) Horseradish		
(ii) Marjoram		
(iii) Mint		
(iv) Parsley		
(v) Thyme		
(vi) Pepper		
(vii) Turmeric		

APPENDIX A - Contd.

SECTION C

For Office Use Only

	For Total Farm Unit	For Area of Farm Within Sample
(d) Food Crops or Provisions: State acreage of each crop		
(i) Yams: Types of Yams planted (check one or more)		
Lisbon (a) ( )		
Horn (b) ( )		
Oriental (c) ( )		
Crop (Hunt) (d) ( )		
(ii) Sweet Potatoes: Types of Potatoes planted (check one or more)		
Black Rock (a) ( )		
White Gilkes (b) ( )		
Caroline Lea (c) ( )		
(iii) Maize		
(iv) Cassava		
(v) Eddoes, Tannias, Dasheen		
Total acreage or number of holes		
(e) Other Crops: Total acreage or number of holes		
(i) Cotton		
(ii) Groundnuts		
(iii) Arrowroot		
(iv) Ginger		

APPENDIX A - Contd.

SECTION C

For Office Use Only

	For Total Farm Unit	For Area of Farm Within Sample
(f) Tree Crops: State number of trees of each type		
(i) Banana		
(ii) Plantain		
(iii) Breadfruit		
(iv) Avocado		
(v) Citrus		
(vi) Coconut		
(vii) Cashew		
(viii) Guava		
(ix) Mango		
(x) Pawpaw		
(xi) Soursop		

9. Livestock: State number of animals kept on enumeration day.

(i) Cattle	
(ii) Sheep	
(iii) Goats	
(iv) Pigs	
(v) Fowls	
(vi) Horses	
(vii) Mules	
(viii) Donkeys	

APPENDIX A - Contd.

For Office Use Only

SECTION D

10. Farm Population: State the number of persons in the farm operator's household.

	Males	Females
(i) 15 years old and over		
(ii) Under 15 years		
TOTAL		

11. Employment in Agriculture: State the number of persons employed in agricultural work on the farm for four weeks or more during the previous 12 month period.

	Males	Females
(i) Farm operator's dependents		
(ii) Other unpaid workers		
(iii) Paid workers		
TOTAL		

12. State time (in average days per week or month) spent in employment away from farm in last 12 months, by farm operator.

_____

APPENDIX A - Contd.

For Office Use Only

SECTION E

13. Farm Equipment: State if any of the following were owned or used by the farm operator in the previous 12 months.

(i) Tractor - owned _____
- hired _____

(ii) Ploughs - horse operated _____
- tractor operated _____

(iii) Transport - horse drawn _____
- motor driven _____

14. Storage:

Were any of the crops harvested during the last 12 months stored?	Yams	Sweet Potatoes	Maize	Cassava	Eddoes Tannias Dasheen
No					
Yes					

For what period was the crop stored?

Days					
Weeks					
Months					

Method of storage -

Pit storage					
Rack storage					
Bag storage					
Other storage					

APPENDIX A - Contd.

For Office Use Only

SECTION E

15. Fertilizers:

	No	Yes
Were any fertilizers applied to farm in last 12 months?		
Check types used :-		
(i) Organic - Pen manure		
- Other (state exact type)		
(ii) Inorganic nitrogenous fertilizers		
Phosphatic fertilizers		
Potassic fertilizers		
Mixed fertilizers		
Lime fertilizers		

16. Water Supply:

Check if Stand Pipe within 220 yards of housespot _____

Check if Stand Pipe within ½ mile of housespot _____

17. Irrigation:

Were crops irrigated during the last 12 months? _____

Check methods used:

(i) Gravity flow _____
(ii) Pumping from ponds or streams _____
(iii) Pumping from wells _____
(iv) Hand watering only _____

Source of water for irrigation: Check one of the following:

(i) Water supply from the farm itself _____
(ii) Water supply from outside farm _____
(iii) Water supply from both on and off the farm _____

APPENDIX A

QUESTIONNAIRE 2

Farm Number _____

Demographic

1. Occupation of Farm Operator _____
2. Occupation of wife _____
3. Occupations of children _____
4. Educational level of children _____
5. Are any members of family abroad? _____

   Where? _____

   Do they send money home? _____

Agricultural

6. Does the woman of the house have any active role on the farm? _____
7. Does she take any part in marketing the farm produce? _____
8. If not, then how is the produce marketed? _____
9. What is the family's attitude to the land? Interested or not? _____
10. Is operation of the farm in the hands of one member only? _____

APPENDIX A - Contd.

11. Do the parents wish their children to work on the land? _____

12. Does the farmer have any farming philosophy? _____

_____

13. What average yields does he get?

(a) Sugar Cane
(b) Food Crops
(c) Vegetables
(d) Others

14. Does the farmer have any special methods or techniques? _____

15. Other remarks _____

_____

_____

_____

APPENDIX A.

QUESTIONNAIRE 3

CATEGORIES OF FACTORS	SYMBOLS
NUMERATOR	
I. The Spacing of Crops :-	
a. Well spaced	1a
b. Over-crowded	1b
II. The State of the Farms :-	
a. Well kept	2a
b. Averagely kept	2b
c. Neglected	2c
III. Quality of Crops :-	
a. Good crops	3a
b. Crops sprayed	3b
c. Attacked by insects or disease	3c
IV. Moisture Conservation on Farm :-	
a. Farm mulched	4a
b. Cover crop planted	4b
c. Soil recently turned	4c
d. Open farm (no mulch or cover crop)	4d
DENOMINATOR	
A. Soil Colour :-	
1. Red	A1
2. Brown	A2
3. Black	A3

APPENDIX A - Contd.

CATEGORIES OF FACTORS		SYMBOLS
B.	**Texture** :-	
1.	Sandy	B1
2.	Loamy	B2
3.	Clayey	B3
C.	**Depth** :-	
1.	Shallow for root development	C1
2.	Deep enough for root development	C2
D.	**Stoniness and Rock Exposure** :-	
1.	No stoniness or Rock exposure	D1
2.	Moderately stony	D2
3.	Stony	D3
4.	Limited Rock exposure	D4
5.	Excessive Rock exposure	D5
E.	**Drainage** :-	
1.	Well drained	E1
2.	Poorly drained	E2
3.	Excessively drained	E3
F.	**Erosion** :-	
1.	Deposition	F1
2.	No observable erosion	F2
3.	Visible sign of erosion	F3
4.	Advanced erosion	F4
G.	**Slope** :-	
1.	Level land	G1
2.	Depressions	G2
3.	Gently sloping land	G3
4.	Steeply sloping land	G4

APPENDIX B

COMMON AND BOTANICAL NAMES OF CROPS, WITH DATE WHEN FIRST NOTED WHERE KNOWN

Local Name	Botanical Name	First Noted
Cassava	Manihot esculenta	1627
Yams	Dioscorea spp.	1627
Maize	Zea mays	1627
Plantain	Musa paradisiaca	1627
Banana	Musa sapientum	1627
Orange	Citrus spp.	1627
Lemon	Citrus limon	1627
Lime	Citrus aurantifolia	1627
Pineapple	Ananas comosus	1627
Melon	Cucumis melo	1627
Sugar Cane	Saccharum officinarum	1627
Pomegranate	Punica granatum	1631
English Potato	Solanum tuberosum	1631
Pawpaw	Carica papaya	1631
Ginger	Zingiber officinale	1639
Coconut Palm	Cocos nucifera	1647
Cucumber	Cucumis sativus	1647
Thyme	Thymus vulgaris	1647
Marjoram	Majorana hortensis	1647
Parsley	Petroselinum crispum	1647
Cabbage	Brassica oleracea	1647
Radish	Raphanus sativus	1647
Lettuce	Lactuca sativa	1647
Tamarind	Tamarindus indica	circa 1650
Cashew	Anacardium occidentale	1676
Pigeon Pea	Cajanus cajan	1684
Cow Pea	Vigna sinensis	1690
Mango	Mangifera indica	1690
Okra	Hibiscus esculentus	1695
Sorrel	Hibiscus sabdariffa	1696
Tomato	Lycopersicum esculentum	circa 1720
Eddoes	Colocasia esculenta	1750
Sweet Potato	Ipomaea batatas	? 1750
Avocado Pear	Persea americana	1750

APPENDIX B - Contd.

Local Name	Botanical Name	First Noted
Ground Nut	Arachis hypogaea	1750
Pumpkin	Cucurbita pepo	1750
Squash	Cucurbita pepo var. melopepo	1750
Egg Plant	Solanum melongena	1750
Breadfruit	Artocarpus altilis	1790's
Carrot	Daucus carota	
Eschalot	Allium ascolonicum	
Beet	Beta vulgaris	
Turmeric	Curcuma domestica	
Red Pepper	Capsicum frutescens	
Grapefruit	Citrus paradisa	
Guava	Psidium guajava	
Sugar Apple	Annona spp.	
Golden Apple	Passiflora laurifolia	
Akee	Melicocca bijuga	
Soursop	Annona muricata	
Barbados cherry	Malpighia punicifolia	
Almond	Terminalia catappa	

APPENDIX C

FIGURE 34

MATRIX OF CORRELATION COEFFICIENTS
PROBLEM 2.

+ The unity values on the principal diagonal are omitted.

" Denotes values of .50 or over.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.
1.	+															
2.	.23															
3.	.31	.49														
4.	.33	.10	.11													
5.	-.17	-.00	-.01	-.13												
6.	.07	.24	.17	-.02	.03											
7.	-.19	-.22	-.18	-.04	.04	-.59"										
8.	-.09	.03	.08	-.12	.15	-.42	-.07									
9.	.22	-.08	-.04	.09	-.17	-.27	-.15	-.04								
10.	.02	-.18	-.12	.13	-.06	-.36	.10	-.07	-.04							
11.	.39	.15	.32	.09	-.03	-.02	-.16	-.09	.52"	-.04						
12.	.14	.09	.07	.13	-.63"	.10	-.08	-.25	.13	-.06	.09					
13.	.42	.29	.18	.07	-.19	.19	-.13	-.15	.03	-.08	.20	.18				
14.	-.25	.03	-.08	-.12	.28	.13	-.00	.03	-.23	-.14	-.23	-.15	-.05			
15.	-.08	.07	.05	-.13	.17	.16	-.09	-.10	-.03	-.09	.11	-.03	.07	.15		
16.	-.13	.01	.03	-.14	.17	.08	-.02	-.08	-.06	-.02	.06	-.10	.02	.16	.86	
17.	-.10	.08	.04	-.04	.13	.13	-.10	-.07	-.08	-.03	-.00	.05	.02	.13	.86	.72
18.	.24	-.04	.10	.25	.04	-.07	-.09	.05	.11	.09	.17	-.02	.17	-.10	-.02	-.08
19.	.27	.26	.12	.12	-.04	.23	-.19	-.06	-.10	-.03	.11	.16	.17	.13	-.07	-.20
20.	.04	-.17	-.04	.04	.12	-.04	.05	-.12	.02	-.03	-.00	.02	.12	-.07	.12	.15
21.	.07	.17	.09	.01	-.05	.37	-.23	-.08	-.27	-.09	.13	.12	.11	.00	.17	.15
22.	.32	.18	.18	-.06	.03	.08	-.08	-.09	.19	-.09	.35	-.04	.17	.03	.02	-.14
23.	-.12	.01	.07	.03	.19	.07	.17	-.07	-.16	-.05	-.01	-.31	-.15	.19	.17	.09
24.	-.12	.10	.10	-.06	.31	.07	.06	.07	-.12	-.18	.09	-.19	-.08	.22	.11	.05
25.	.05	.15	.12	.07	.22	.06	.05	-.08	.01	-.08	.12	-.20	-.11	.06	.05	.02
26.	-.14	-.00	.06	-.02	.30	-.05	.12	-.03	-.09	.04	.04	-.26	-.06	.01	.08	.14
27.	.04	-.02	-.01	.13	.29	.08	.04	-.02	-.05	-.14	.08	-.04	-.09	.14	.12	.03
28.	.19	-.03	.10	.21	-.04	-.17	.16	.07	.12	.00	.11	.01	.18	-.09	-.02	-.03
29.	-.06	-.21	-.19	.04	-.15	-.09	-.07	.02	.15	.24	-.06	.07	.03	-.17	.03	.07
30.	.00	.06	.01	.12	.11	-.09	.11	-.05	-.04	-.01	.09	.02	.02	-.12	-.03	.03
31.	.16	.11	.06	.06	-.26	.11	-.07	-.19	.15	-.15	.18	.30	-.08	-.26	-.19	-.25
32.	.07	.25	.12	.14	.00	.07	-.02	-.06	.12	-.12	.19	-.07	.19	.10	-.03	-.17

	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.	31.	32.
18.	.01															
19.	-.02	.19														
20.	.13	.01	-.04													
21.	.16	-.01	.25	.09												
22.	.00	.08	.23	.05	.01											
23.	.15	.11	.08	-.05	-.06	.10										
24.	.08	.02	.07	.01	-.13	.01	.30									
25.	.08	-.02	.10	.04	-.02	.26	.25	.33								
26.	.08	.16	-.08	.15	-.01	-.13	.27	.26	.39							
27.	.09	.08	.11	.14	-.05	.15	.22	.45	.39	-.01						
28.	.01	.09	.12	.12	.05	.01	.07	.09	.07	.11	.10					
29.	.15	.00	-.09	.03	.06	-.03	-.16	-.27	-.01	-.15	-.04	.07				
30.	.04	.15	.14	-.01	.15	.09	.05	.05	.12	.09	.16	.42	.05			
31.	-.07	.10	.21	-.04	.02	.11	-.08	-.17	.01	-.21	-.04	-.04	.09	.05		
32.	.04	.19	.26	-.01	.05	.32	.25	.11	.29	.10	.12	.21	-.03	.15	.17	

APPENDIX C

FIGURE 35

ROTATED 'R' MODE ANALYSIS FACTOR STRUCTURE. PROBLEM 2

	FACTORS											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1.	-.15	-.40	-.15	.00	.09	.30	-.09	-.12	.49	.10	.30	.16
2.	-.07	-.78	.04	-.05	.17	-.07	.01	-.01	-.00	.19	-.06	-.09
3.	.02	-.80	.04	-.02	.07	.15	-.03	.05	.06	-.01	.06	-.13
4.	-.26	-.16	-.11	-.09	-.05	-.02	-.27	.08	.10	-.05	.60	.23
5.	.74	.06	.11	-.02	.10	-.06	-.29	.13	-.02	.02	-.04	-.11
6.	-.16	-.11	.10	.24	.77	-.20	-.09	.15	.11	.13	-.03	-.21
7.	-.09	.17	-.06	-.20	-.77	-.21	-.03	.21	.01	.04	-.17	-.04
8.	.52	-.17	-.10	-.22	-.12	.06	.08	-.52	-.28	-.21	.02	-.06
9.	-.09	.11	-.02	.01	-.09	.84	.04	-.11	.02	.02	.06	.04
10.	.06	.02	-.03	.15	-.33	-.15	.10	.09	.04	-.06	.27	.69
11.	-.06	-.28	.08	-.03	.00	.73	-.09	.06	.14	.14	.13	-.06
12.	-.81	-.06	.03	-.05	.06	.05	.03	-.18	.10	-.11	.02	-.05
13.	-.11	-.23	.06	-.08	.07	.02	.24	-.09	.70	.21	.14	-.08
14.	.23	.16	.20	.23	-.05	-.42	-.14	-.25	-.00	.34	-.00	-.31
15.	.04	-.03	.96	.03	.07	.03	-.06	.02	.05	.02	-.03	-.04
16.	.11	-.12	.91	.01	.00	-.00	.01	.07	.06	-.16	-.08	-.00
17.	-.04	-.01	.91	-.07	.09	-.04	-.07	.02	-.05	.06	.01	.08
18.	.13	.07	-.02	-.12	.10	.22	.10	.06	.02	.15	.76	-.04
19.	-.14	-.17	-.11	-.14	.28	-.17	-.11	-.17	.07	.49	.26	-.03
20.	.05	.31	.10	-.16	.08	.09	-.17	.24	.58	-.15	-.11	-.01
21.	-.06	-.13	.15	-.29	.55	-.36	.15	.03	.14	.06	-.07	.14
22.	.07	-.14	-.07	.03	.06	.30	-.18	-.11	.27	.64	-.20	.14
23.	.15	-.00	.18	.04	-.19	-.16	-.18	.35	-.25	.42	.21	-.19
24.	.25	-.12	.08	-.02	-.10	-.03	-.57	.10	-.09	.02	.05	-.45
25.	.19	-.21	.00	-.06	.01	.12	-.55	.41	-.10	.29	-.18	.14
26.	.36	-.05	.08	-.16	-.07	-.04	.02	.74	-.01	-.05	.13	.11
27.	.06	.09	.07	-.11	.03	.00	-.86	-.09	.03	.08	.08	-.09
28.	-.01	-.04	.00	-.72	-.22	.04	-.04	-.01	.23	.08	.15	-.03
29.	-.05	.27	.13	-.16	.12	.13	.06	-.15	-.08	.00	-.07	.67
30.	-.01	-.01	.02	-.73	.01	-.01	-.10	.07	-.05	.12	.03	.05
31.	-.52	.02	-.20	-.11	.27	.31	.01	.08	-.30	.20	-.04	.01
32.	-.00	-.07	-.04	-.24	.02	.10	.01	.14	-.03	.73	.11	-.08

VARIABLE IDENTIFICATION NUMBER	VARIABLE NAME
1.	Acreage
2.	Number of parcels
3.	Distance of furthest parcel
4.	Rented land
5.	Price
6.	Percentage of sugar cane
7.	Percentage of vegetables
8.	Percentage of food crops
9.	Percentage of pasture
10.	Percentage of trees
11.	Number of animal units
12.	Distance from Bridgetown
13.	Labourers
14.	Work off farm
15.	Size of family
16.	Number of children
17.	Number of women
18.	Tenure
19.	Mechanisation
20.	Water supply
21.	Fertiliser
22.	Transportation
23.	Soil
24.	Slope
25.	Depth of soil
26.	Stoniness
27.	Erosion
28.	Efficiency
29.	Woman's role
30.	Attitude to farming
31.	Family abroad
32.	Education

FACTOR IDENTIFICATION NUMBER	FACTOR NAME
I	Urban Influence
II	Fragmentation
III	Demographic
IV	Motivation
V	Crops
VI	Livestock
VII	Erosion
VIII	Stoniness
IX	Employment
X	Education
XI	Tenure
XII	Woman's Role