THE CULTIVATION OF FOOD CROPS IN BARBADOS

BY

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A Thesis submitted to the Faculty of Graduate Studies and Research in partial fulfilment of the requirements for the degree of Master of Arts.

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PREFACE

It was during the series of talks the writer had with Professor Theo L. Hills, Director of Tropical Research of the Department of Geography, on the problems of peasant agriculture in Barbados that the topic of this research project was hinted at. It was not until the writer arrived in Barbados, however, that the title of the thesis was finally chosen. The writer is much indebted to him for supervising this research project and for his guiding suggestions both during the field investigation and the analyses of the data collected from the field.

The writer should like to express his gratitude to Mr. V. Sargeant, Head of the Extension Service of Barbados Ministry of Agriculture, and the members of his staff, especially the Extension Officers who helped with the collection of data from the peasants during the sample survey. The writer expresses much appreciation to Miss Nel Bretney, Librarian of the Agricultural Department, for her help during the library research and particularly in the compilation of the Bibliography on Food Crops in Barbados.

The ready advice of Professor L. J. King in the analyses of the statistical data used in the preparation of the maps is very much appreciated. The writer is also grateful to Professor F. C. Innes and Mr. N. K. B. Sinha, both of the Geography Department, who helped to read

through some of the chapters of the thesis and offered their advice and suggestions. For the preparation of the maps during the final stages, the writer is indebted to Miss Carolyn Weiss of the Department of Geography, and to Miss Margot Blackman who read through the script and helped in correcting typographical errors. The writer should also like to thank his wife for her cooperation and encouragement during the preparation of this thesis.

Finally, the writer should like to express his appreciation to the Canadian Universities Foundation and the External Aid Office for providing the funds which made this research project possible.

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LOCATION MAP

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Second Edition.
10,000/6/56 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 1

CHAPTER I.

INTRODUCTION

The term "Food Crops" as used in this thesis embraces Root Crops (which are generally referred to as "Ground Provisions" in Barbados), Fruit trees, Vegetables, and Seasonings. There are many types of these food crops cultivated in Barbados and it would be beyond the scope of this work to treat the cultivation of all of them in detail. All that shall be attempted therefore is a consideration of those crops commonly cultivated on the island.

The food crops which are most commonly cultivated in Barbados are listed as follows:- (i) Ground Provisions: Yam, Sweet potato, Corn (Maize), Eddoe, and Cassava. (ii) Fruit trees: Breadfruit, Banana, Mango, Avocado pear, Citrus, and Plantain. (iii) Vegetables and Seasonings: Cabbage, Beans, Cucumber, Pumpkin, Tomato, Peas, Lettuce, Horseradish, Marjoram, Pepper, Thyme, Ginger, Parsley, and Tumeric. A complete list of all the other food crops cultivated in Barbados is in Appendix I.

Any visitor travelling through Barbados could hardly fail to notice the large number of peasant holdings on which food crops are interplanted with sugar cane. These small holdings can be seen beside the roads, on

the hillsides, and attached to almost every dwelling in both the rural and suburban areas of Bridgetown. The very distribution of these holdings and their varied contents prompts one to ask which crops are grown and what part they play in the food supply of the island.

Further investigation reveals that food crops are grown in pure stands on the plantations also. Food crops are planted from about May to early July on lands which are being prepared for cane planting in November. The area of land used for the planting of these "Catch crops" is referred to as the "preparation land". The "Long crops", usually planted towards the end of the year, are planted on what is known as the "thrown out land". This is the area of the plantation on which sugar cane would not be planted until the following year.

In spite of the fact that food crops are cultivated on almost all peasant holdings and also on the plantations, most of the food requirements of the island come from other countries and from the neighbouring islands. Why is it necessary to import basic foodstuffs if their substitutes could be produced on the island? The answer is aptly put by Jolly[1] when she wrote: "The West Indian peasant relies heavily on a cash economy. He sells most of his produce and buys most of his food. This is often forced on him by the danger of larceny, the difficulty of storing local foods through the year, and the cheapness, durability and ready availability of imported foods."

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1. Small Scale Farming in the West Indies - A. L. Jolly; World Crops, Vol. 8, No. 5 - May 1956

The island had been dependent on sugar cane for a long time to the exclusion of all other crops. The relative ease with which imported foods could be purchased with the ready cash obtained from the sale of sugar cane made the cultivation of food crops incidental. This way of living has become almost a tradition and it had been encouraged by the government in many ways.

The Department of Science and Agriculture had in the past concentrated all its resources on experiments designed to improve the quality of sugar cane cultivated on the island. Experiments on the improvement of the food crop cultivation, on the other hand, were only carried out whenever there was a danger of food shortage. It is agreed that adequate production of sugar cane is necessary if all the sugar factories on the island are to be kept producing at an economic level, but this consideration alone should not exclude the improvement of food crop cultivation. The sugar trade is dependent on an agreement with Great Britain, which is due to expire in 1971. When this agreement expires, it is possible that sugar may cease to sell at a profitable price and then the people may not have enough money to buy imported foods. If such a time ever arrives, as it has in the past, then the island would be better off if it is self-sufficient, to a degree, in its food supply.

The necessity for a thorough investigation into the system of food crop cultivation is made even more urgent by the rapidly increasing

population. The population density now stands at over 1,040 people per square mile and this figure continues to increase annually. The area of the land available for cultivation, however, is a bare 166 square miles, and practically all the cultivable land is under cultivation and no uncultivable areas exist which could be brought into production.[1] The only solution, as suggested in the report of the West Indian Royal Commission of 1938-39, is more intensive use of the land and the development of peasant agriculture.[2]

The Department of Science and Agriculture in recent years has appointed Extension Officers to look into the improvement of peasant agriculture on the island. These men are doing a useful work but the emphasis is still on sugar cane cultivation. Recently the cultivation of Garden Vegetables has been much encouraged and this could be extended to the cultivation of the other food crops. The problems to be faced are those concerning the environment, viz. the seasonal variations of the climatic elements, the suitability of the different types of soils to the cultivation of the various food crops, and the large scale production of the most important crops.

It is the importance of food crop cultivation to the economic future of Barbados that has prompted the carrying out of this research project. The primary objective of the research is not to find a solution to the

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1. Agriculture in Barbados - Colonial Development and Welfare in the West Indies. - Colonial, No. 182; 1940.
2. West Indian Royal Commission 1938-39 - London. 1940.

problems involved in the production of all the food requirements of the island; rather, it is aimed at investigating the potentialities of the different parts of the island for the cultivation of the basic food requirements that could be produced economically on the island.

There are some basic problems facing food crop production on the island, and most of these are concerned with the environmental, economic and social factors. The extent to which all these affect the cultivation of food crops on the island form the basis of the chapters that follow.

The sequence of introduction of the food crops into the island throws some light on the pattern of distribution now found. A consideration of the historical aspects of food crop production, therefore, forms the basis of the first part of this writing. The environmental factors, namely, the topography, the climate and the soils, which are the main determinants of cultivation, were then considered with respect to the island.

The distribution pattern of cultivation on the island at the present time should be well understood before any suggestions as to future distribution could be given. In order to understand this fairly accurately, a random sample survey was based on Anderson's map[1] of peasant agriculture distribution on the island. The random sample survey involved 10% of the area of peasant agriculture shown on the map, and 58 sample units

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1. Anderson, J.R. - "Barbados, Land Use Map" - McGill University - 1961.

were chosen to cover the island. A system of sub-sampling was adopted within each of the sample units and a questionnaire was used to collect the basic facts. The details of the methods used in this survey and an analysis of the data collected form the basis of another chapter. A complete enumeration of the plantations was attempted but the response was very poor. The number of questionnaires returned, however, was used to establish the trend of cultivation within the plantations.

The factors of rainfall, both its annual and seasonal distributions, the nature of the soils and the topography of the island were used as determinants to delimit areas which might give the best yields for each of the main food crops of the island. In this connection, the maps showing the average slopes, the flatland ratio, the monthly dispersion of rainfall and its annual variability, prepared by the writer together with the preliminary soils map of the island prepared by Caroll, D.[1] formed the basis of this delimitation. It should be noted, however, that local factors within these optimum areas might affect production.

The possibilities of increased production of food crops on the island were then considered and the economic and social factors which might limit such increase were discussed. The details of the research methods used and the deductions made from them are discussed in detail under the appropriate chapters.

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1. Caroll, D. - Soils map of Barbados - 1963.

CHAPTER II

THE INTRODUCTION OF FOOD CROPS INTO BARBADOS AND THE ROLE OF THE PLANTATIONS IN THEIR CULTIVATION.[1]

Almost all the food crops cultivated in the tropical countries and many of those cultivated in both the sub-tropical and temperate countries have been cultivated in Barbados at one time or another. Some of these crops failed because the conditions were not suitable for their cultivation. Some managed to survive but produced below what is their optimum in more suitable situations, while others became well established because the environment was ideal for their cultivation.

The first settlers on the island of Barbados were the Arawak Indians and these were later followed by the Carib Indians. They practised a form of cultivation and the crops they planted probably included the Indian Corn (Maize),

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1. This chapter draws to a very large extent on the publications stated below, especially the thesis of Watts, D. on "Plant Introduction and Landscape Change in Barbados 1625-1830". The use of all these materials is hereby acknowledged. Detailed considerations of the points discussed can be found in the references given below:

   I. "Plant Introduction and Landscape Change in Barbados 1625-1830" - Watts, D. McGill University Ph.D. thesis 1963.
   II. "The Economic Geography of Barbados" - Otis Paul Starkey Columbia University Ph.D. thesis 1939.
   III. "A True and Exact History of the Island of Barbados" - Ligon, R. - London, 1657.
   IV. "The Natural History of the Island of Barbados" - Hughes, Rev. G. - London, 1750.

and the Cassava. These people had, however, disappeared long before the arrival of the first European settlers in 1627, and most of the evidence of their cultures disappeared with them. The first settlers therefore had to introduce the various food crops now cultivated on the island.

The first set of food crops introduced were brought from the Dutch Colony of Guiana and they included Yams, Cassava, Indian Corn (Maize), Pulses, Plantain, Banana, Orange, Lemon, Lime, Pineapple, and Melon. The Arawak Indians were again invited to teach the settlers the art of cultivating these crops. Later, in the early period of settlement, many other food crops as well as commercial crops were introduced.

The cultivation of yams became very important almost immediately after its introduction,probably as a result of its pleasant taste and its food value. Its cultivation was also extensive and records confirm that it was grown in the remotest sections of the island where it was occasionally subject to destruction by monkeys.

The Sweet Potato was not mentioned among the crops introduced from Dutch Guiana. It was first identified by Hughes and he called it "Wild potato vine"[1]. Sweet Potato was said to have been grown in great abundance and was one of the staple foods. This crop was probably not introduced into Barbados until 1750.

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1. Hughes, Rev. G. - op.cit., pp. 198 & 288.

In order to add variety to the Barbadian food plants, three types of Eddoe were introduced from the Pacific Islands before 1700. They were identified as 'roasting', 'scratching', and 'blue' Eddoes, all said to be similar to each other. Perhaps these three types described here are identical with what are now known as Eddoe, Dasheen and Tannia, all of which look alike except that they differ in size. These Eddoes were utilized not only for their large tuberous roots, but also for their blanched shoots.

The Cassava, as stated earlier, was probably planted by the Arawak and the Carib Indians who first occupied Barbados before the European settlers. This crop was one of those reintroduced from Dutch Guiana. The type introduced was the poisonous or the Bitter Cassava. The second type now planted, the Sweet Cassava, was not introduced until several years later. The Cassava was not only prized for its tubers which were mixed with Maize to make a type of bread, but also for its leaves which were used as vegetable.

The Indian Corn, as the name suggests, is undoubtedly a traditional crop of the Indians. The importance of its cultivation in Barbados was confirmed by Ligon during his visit to the island. He stated that Maize was a most common crop in Barbados, being planted on many plantations among fallen timber, and using methods which were introduced by the Arawak Indians. It was also an important food for plantation owners, their white servants, negroes, and animals. Most estates had a building used solely for

its storage. Maize was such an important item of food that its scarcity invariably caused a shortage in the food requirements of the island. It was also so widely cultivated that there was always surplus for export to other islands during periods of good harvests. The island at this time had been referred to by contemporary writers as the 'Granary' for all the rest of the Lesser Antilles.

The Guinea Corn was not introduced into Barbados for several years in spite of the movement of thousands of slaves from West Africa where it is one of the staple foods of the people. This Corn was introduced in 1665 by one Colonel Codrington, and it was also referred to as "False Corn", and "Flag Corn". It soon became an important food source both for the Negro slaves and for cattle or sheep. It was well suited to the Barbadian conditions. It was widely distributed all over the island but the main areas of cultivation were enclosed within a line drawn from Bridgetown to the Grove estate in St. Philip's parish, including part of St. Michael, Christ Church, and St. George.

Among the Fruit trees introduced at the earliest stage of settlement were the Plantain, the Banana, the Citrus (Oranges, Lemons, and Limes), and the Pineapple. The cultivation of the Lime and the Lemon was said to be very successful while that of the Orange was not so successful. The Pine-apple, the most prized of all the fruits, consisted of two varieties, the King

and the Queen. The King variety was said to be larger than the Queen, but the latter was said to have had a greater delicacy of taste.

The Plantain was probably introduced along with the Banana. The Plantain was, however, more extensively planted and it is found all over the island. There were numerous plantations of Plantain in the environs of Bridgetown, and there were also occasional plots on the terrace above the second high cliff. It was an article of great consumption both by the Negroes and the Whites, and at one stage, it was the principal item of food. The Banana, on the other hand, did not become a favourite item of food, probably due to its sweetness. The Plantain plantations later became exhausted and consequently its consumption decreased.

The Mango is one of the favourite fruits of the island, and it became widely cultivated soon after its introduction. Another important and widely cultivated fruit tree introduced into Barbados during the seventeen-twenties was the Avocado Pear or the Alligator Pear. Early records suggest that three varieties of this fruit were grown, namely:- the red, the white and the green. Only the green variety is now found on the island and the others might have disappeared later after their introduction.

There were many other fruit trees introduced into Barbados during the early stage of settlement. Some of these, like the Oil palm, the Date palm, the Vine, the Fig tree, and the Pomegranate were found not suited to

the Barbadian environment. Others, however, like the Pawpaw, the Guava, and the Coconut survived in many places on the island. They had their greatest density in the higher and wetter areas and especially in the vicinity of steep-walled Gullies which were sheltered from the tradewinds. But they were not well taken care of and many of them never had their fruits reaped.

The earliest records suggest scarcity of vegetables and seasonings. The Cassava leaf was said to be the main vegetable before Ligon introduced some vegetables and seasonings along with herbs and flowers in 1631. Among these introductions were:- Rosemary, Thyme, Winter Savoury, Sweet Marjoram, Parsley, Pennyroyal, Camomile, Sage, Tansy, Lavender, Lavender Cotton, Garlic, Onions, Colworts, Cabbage, Turnips, Radishes, Marigolds, Lettuce, Taragon, and Southernwood. Other vegetables like the Eggplant, the Tomato, and the Okra were later added.**

The first commercial crops introduced into Barbados were the Tobacco, Indigo, and then the Cotton. The cultivation of these commercial crops was carried on along with the cultivation of the food crops. The introduction of the Sugar Cane as a commercial crop caused a great reduction in the cultivation of food crops, although Cassava, Yam, and Maize still remain commonly cultivated. The land utilization picture at this

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** For the List of Food Crops with the approximate date of introduction see Appendix II.

time is well illustrated by the record of a plantation in 1650 given below:[1]

Products	Acres
Sugar cane	200
Woodland	120
Pasture	80
Ground provision	70
Tobacco	30
Ginger	5
Cotton	5
TOTAL	510

It can be seen from this record that only 2/5 of the whole estate was devoted to the cultivation of sugar cane while about 1/7 was still planted in food crops. There was also a possibility of expansion of food crop cultivation as about 1/4 of the land was still wooded.

The increase in the number of slaves brought in soon made it impossible for the plantations to supply all the food requirements and as a result food had to be imported. The profitable trade of sugar led to the expansion of sugar cane cultivation and the cultivation of food crops became almost totally neglected. The relative cheapness of the food materials imported also made it not pressing to cultivate more food crops locally and their cultivation became incidental. The slaves were, however, encouraged to raise provisions, hogs and poultry around their houses. The plantations were occasionally compelled to resume the cultivation of food crops at times

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1. Ligon, R. - op. cit., 2nd Edition, 1673.

of crisis such as that of sugar cane crop failure due to drought, and at times when the importation of food materials was made difficult by external factors.

The emancipation of the slaves brought another phase into the cultivation of food crops. There were some small land owners made up of free men and a few slaves who bought their freedom before emancipation and these men formed the nucleus of the peasant farmers of the island. The freed slaves, who swelled the number of these peasant farmers after emancipation, made them an important factor in the production of food crops on the island. These freed slaves were handicapped by the lack of good land on which they could farm as the areas of land left uncultivated by the estates were generally the poorest on the island. The breaking up of marginal estates helped to put more lands in the hands of the peasants who could afford to pay for them. These peasant farmers grew Sugar cane in imitation of the plantations, but they also grew ground provisions along with the Sugar cane. The large production of food crops resulted in some surplus, and yams were exported to British Guiana[1] during the nineteen-thirties.

The cultivation of food crops on plantations had been a subject for legislation since the 17th century. In 1631, at a time when Tobacco was the main commercial crop, an Order in Council had to be passed to restrict the

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1. Agricultural Journal, Vol. 5, No. 2 (April 1936), p. 47.

plantations from the planting of Tobacco until such time as more food materials were raised. There was a boom in the sugar trade just after the First World War and the high price paid led to an increase in the Ratoon crops. As a result, the planting of ground provisions was neglected and it had to be enforced by another Order of Parliament. The area to be planted, and the control of reaping and sale, had to be determined by a Committee appointed under the "Vegetable Produce Act". A similar Act was passed in 1938 and it was known as the "Local Food Production (Defence) Control Order". The Act was re-enacted in 1942 and it was known as the "Local Food Production (Defence) Control Order, No. 2, 1942".[++] All the details of food crops to be planted by the plantations and the directives for their planting are included in this Control Order.

The cultivation of food crops in Barbados evolved as a continuous process and it is difficult therefore to draw a sharp dividing line between the different stages of its evolution. Nevertheless, three main stages of development are unique in the process of this evolution. The first stage is that of settlement when the various food crops were introduced and, as it has been pointed out earlier on, some of these were not tropical crops and therefore did not survive. The crops were not all introduced at the same time but were introduced gradually, sometimes quite accidentally. Along with these food crops, different types of commercial crops, chief among which

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[++] See Appendix III for the "Local Food Production (Defence) Control Order, No. 2, 1942". (1963/64).

were the Tobacco, the Indigo and the Cotton, were introduced. These commercial crops reduced the attention given to the cultivation of food crops, especially at periods of boom.

The second stage arrived with the introduction of sugar cane as a commercial crop. This new introduction,coupled with the mass importation of slaves from West Africa, brought a new epoch into the cultivation of food crops. Both the importation of food materials (which were found to be cheap), and the high value fetched by sugar, combined to remove the emphasis formerly placed on the cultivation of food crops. Gradually, the best areas of land were planted in sugar cane and only the poor areas were left for the cultivation of the food crops, when such crops were cultivated at all. It was only during periods of adversity that the plantations were forced by legislation to grow food crops. The period before emancipation witnessed a renaissance in the cultivation of food crops. Both the Council of Barbados and the Agricultural Society urged the increase in the area of land under food crops, and a reduction of the area under sugar cane.

The third stage of food crop cultivation is the period after the emancipation of the slaves. This period brought in the small land owners, otherwise known as the peasant farmers, and they brought about a change in the cultivation system. The inter-cropping of the food crops with sugar

cane became the main trend on these small farms. The plantations too were later compelled by legislation to put about 12% of their land under food crops every year.

CHAPTER III

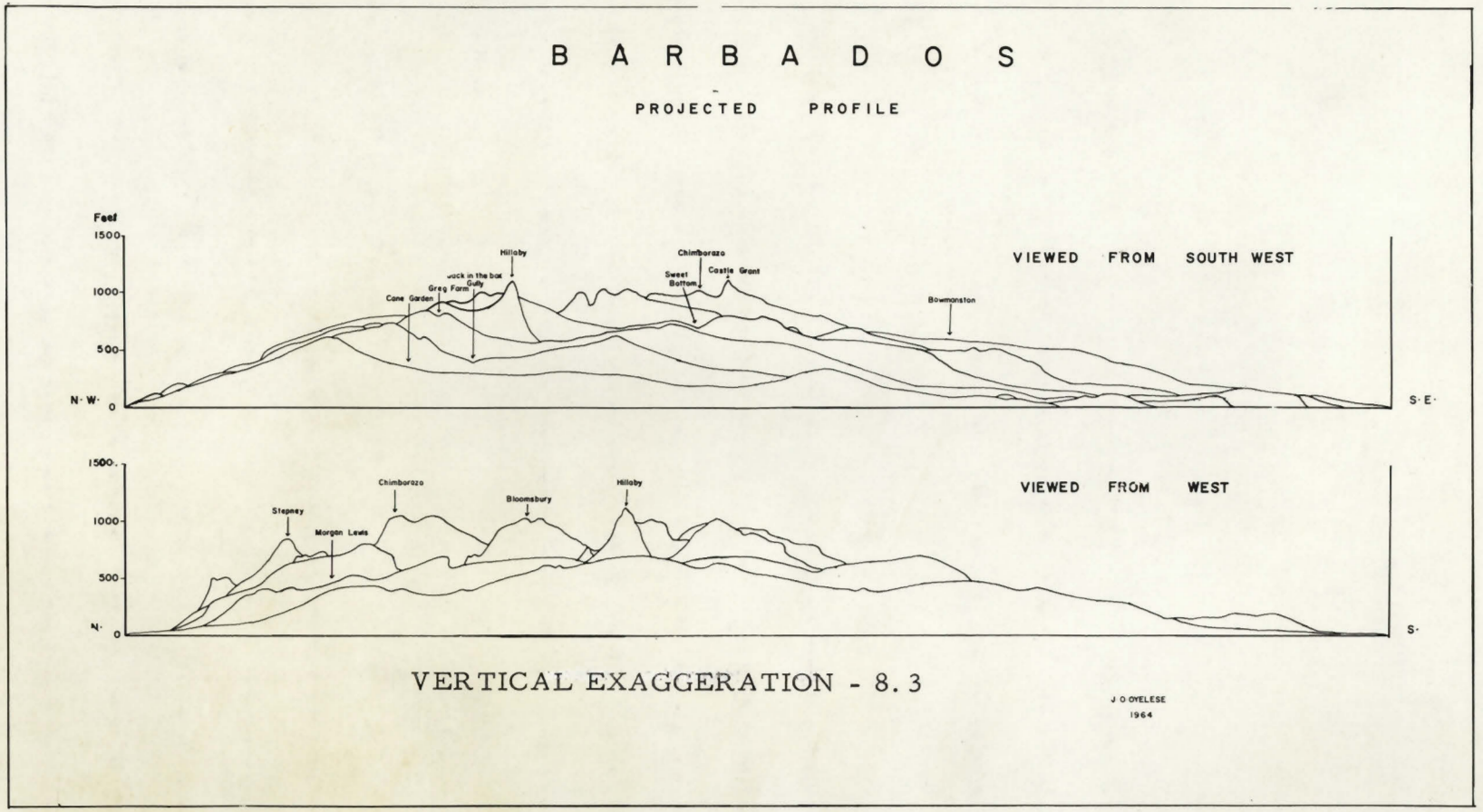
THE FACTORS INFLUENCING FOOD CROP CULTIVATION IN BARBADOS.

The island of Barbados, in spite of its small size, is by no means homogeneous in its environmental factors. There are many significant variations in its topography, its climate and in the distribution and nature of its soils.

The environmental factors, primarily those of soils and climate, are the most important determinants in crop cultivation on the island. The influence of the soil factor has been greatly minimized, however, through the application of manure and fertilizers over a long period of time, but the climatic factor, mainly that of rainfall, exercises a decisive influence on cultivation.

THE GEOLOGY AND TOPOGRAPHY:

Our concern with the geology of the island is that of how the surface soils have been affected by the parent materials that constitute the core of the island. About 6/7 of the island lies on a core of sedimentary rocks encased in a covering of Coral Limestone. This core is exposed in the remaining 1/7 of the island, in the part commonly known as the Scotland



Figures 2a and 2b

District. The series exposed in this part are those of much folded beds of sandstone and clay known as the Scotland Series, and a second composed of siliceous and calcareous clays, known as the Oceanic Series. Barbados, unlike its neighbours, is not a volcanic island. The traces of volcanic ash found mixed with its surface soils were transported to the island by wind from the island of St. Vincent at the turn of the century.

A consideration of the topography of the island entails a discussion of its configuration, the amount of flatland available for easy cultivation, the degree and the direction of slopes, and the smoothness and roughness of the land. All these could be associated with the geological divisions of the island, namely, the Coralline Limestone areas and the Scotland District areas.

The Coralline Limestone Areas:- The Coralline Limestone area of the island is not a flat one as many casual observers who have visited the other volcanic islands might conclude. The area is better described as hilly with rolling plains towards the south. If observed from the south west, the island rises from a rolling plain to a series of low hills which increase in height towards the north east, culminating in peaks like Mount Hillaby, Chimborazo and Castle Grant. From the western side, the island rises in well-defined steps until the highest part of the uplands is reached. These terraces or cliffs rise abruptly from the flatlands usually found between adjacent cliffs. The contrast between the much broken up country to the north and the relatively flatlands of the south is also well shown. (Figs. 2a + 2b)

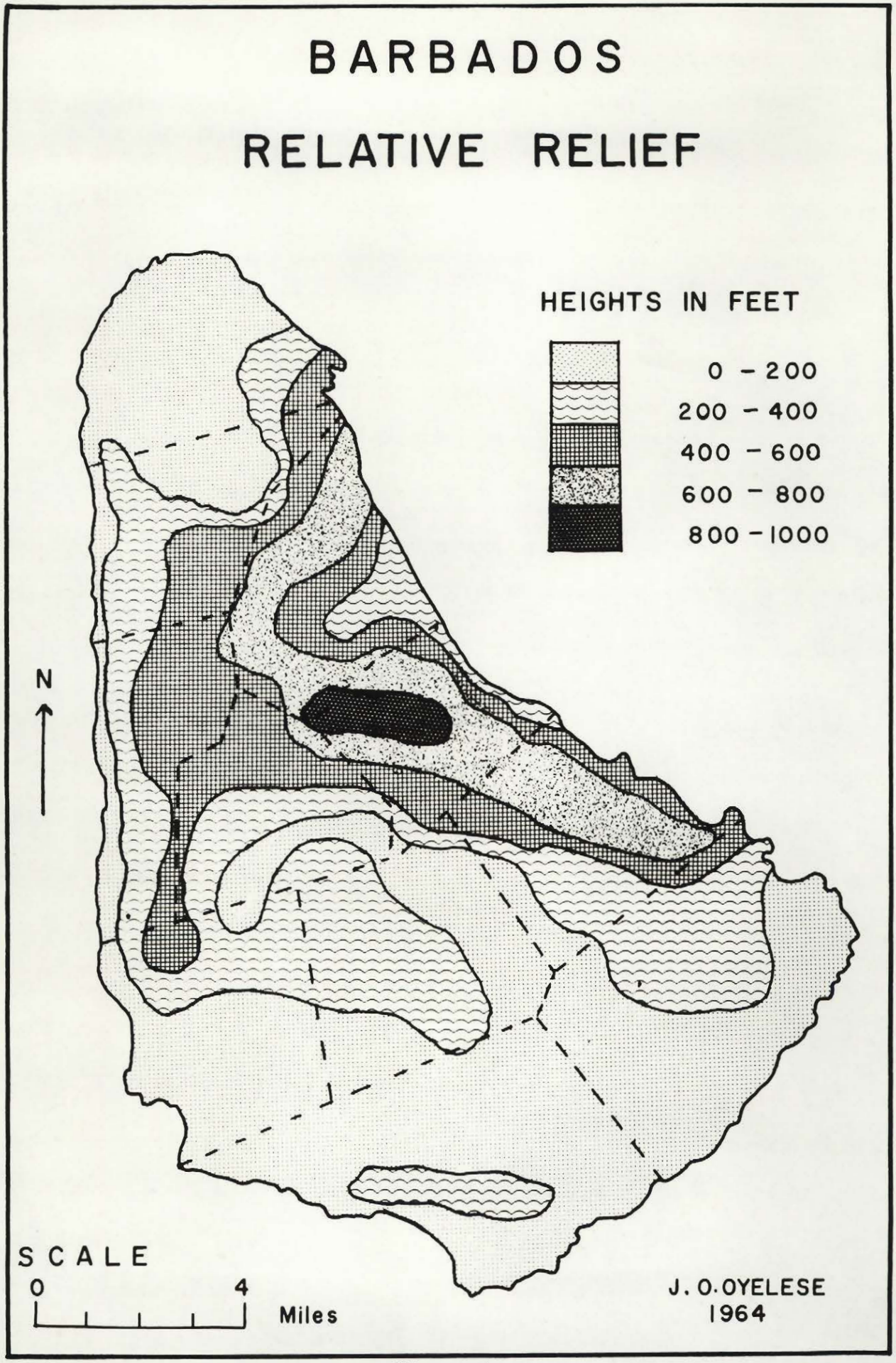

BARBADOS
RELATIVE RELIEF
HEIGHTS IN FEET
0 - 200
200 - 400
400 - 600
600 - 800
800 - 1000
N
SCALE
0
4
Miles
J. O. OYELESE
1964

Figure 3

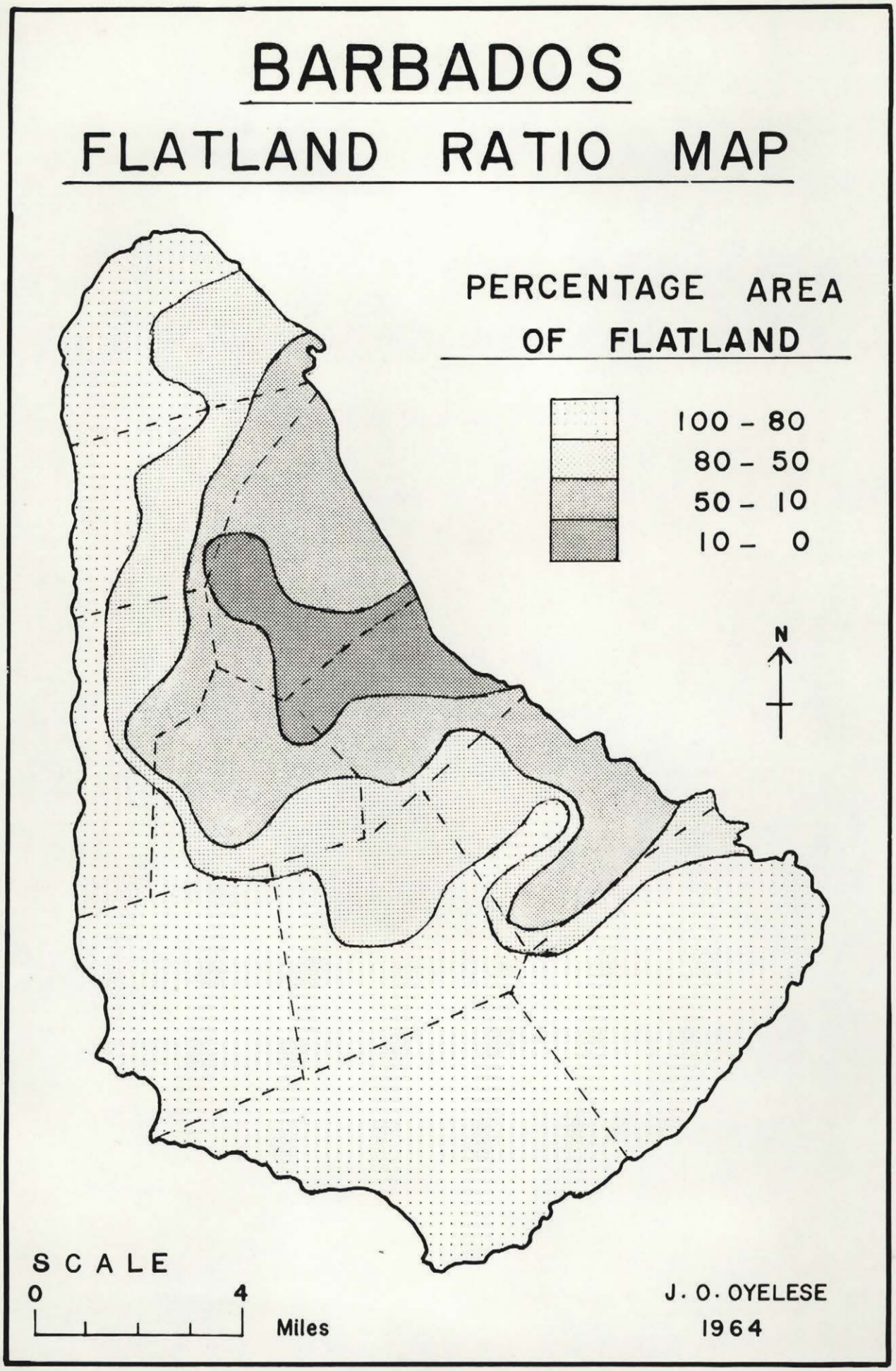

BARBADOS
FLATLAND RATIO MAP
PERCENTAGE AREA OF FLATLAND
100 - 80
80 - 50
50 - 10
10 - 0
N
SCALE
0
4
Miles
J. O. OYELESE
1964

Figure 4

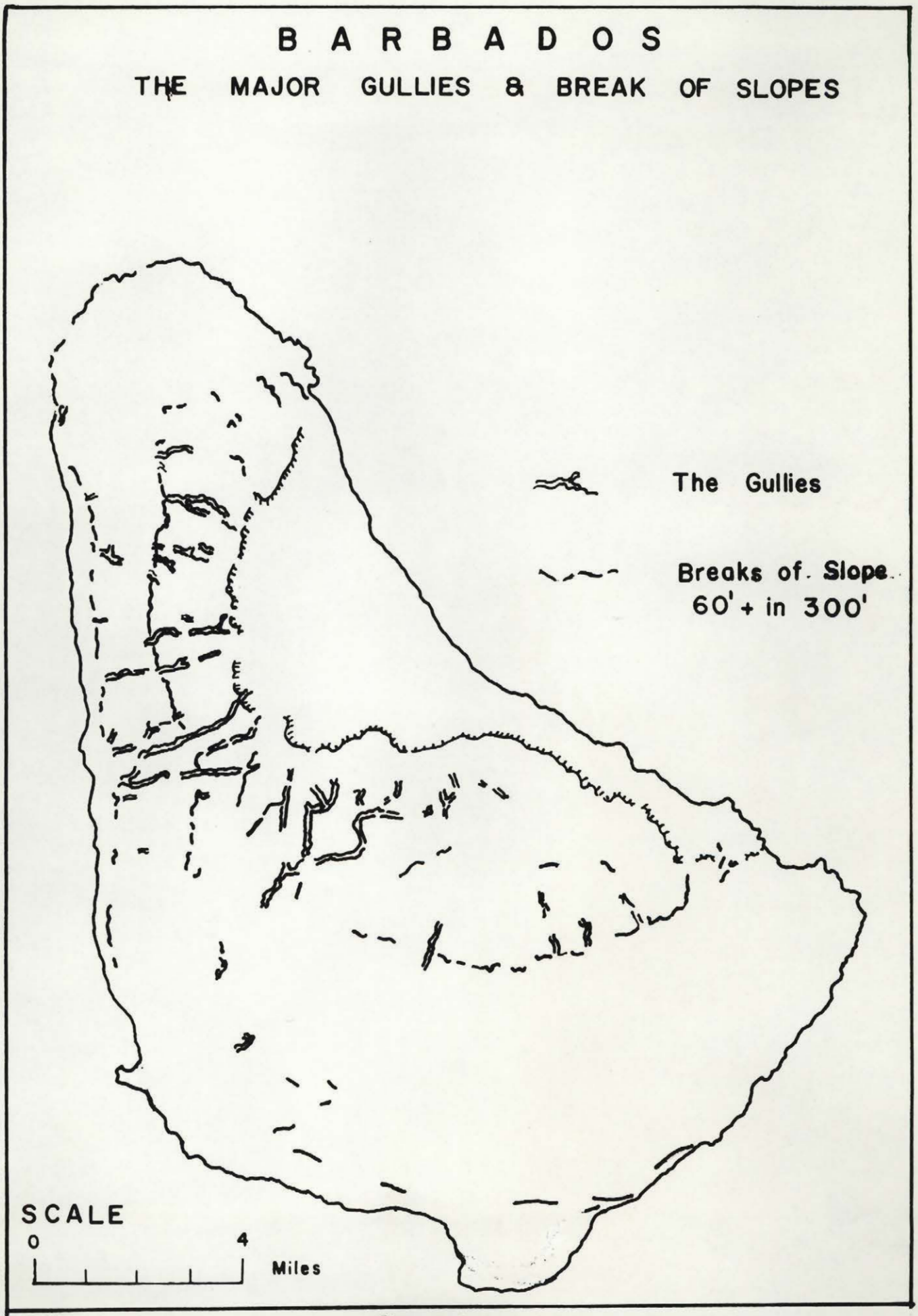

B A R B A D O S
THE MAJOR GULLIES & BREAK OF SLOPES
The Gullies
Breaks of Slope
60' + in 300'
SCALE
0
4
Miles

Figure 5

The relative relief map of the island (Fig. 3) shows the rather moderate amplitude of the land in the Coralline Limestone areas. The differences in relief are very slight and even negligible in some parts. A comparison with the Flatland Ratio map (Fig. 4) confirms this statement. About half the area of the island has about 80% of its land surface flat, as does over 50% of the higher parts of the Coralline Limestone area. It is evident therefore, that topography does not constitute a serious obstacle to cultivation in the Limestone area.

The Gullies:- A conspicuous feature of the Coralline Limestone area are the gullies which are found mainly on the western and southern sides of the uplands (Fig. 5). These gullies are of various depths and widths. The deep gullies have almost canyon-like walls near the cliff faces and they reach a depth of about 150 feet. They broaden out on the terraces between the cliffs and they also become shallower. The sides of these gullies are covered with skeletal soils and in some places there is extensive rock exposure. The soils removed from the steep sides are deposited at the bottom of the gullies forming a fairly thick layer which appears to be fertile. As the coast is approached the depths of the gullies reduce into shallow depressions and, in some cases, they disappear altogether.

An example of these deep gullies is the Sailor's Gully in the parish of St. Peter, investigated by the writer. It descends to a depth of about 200

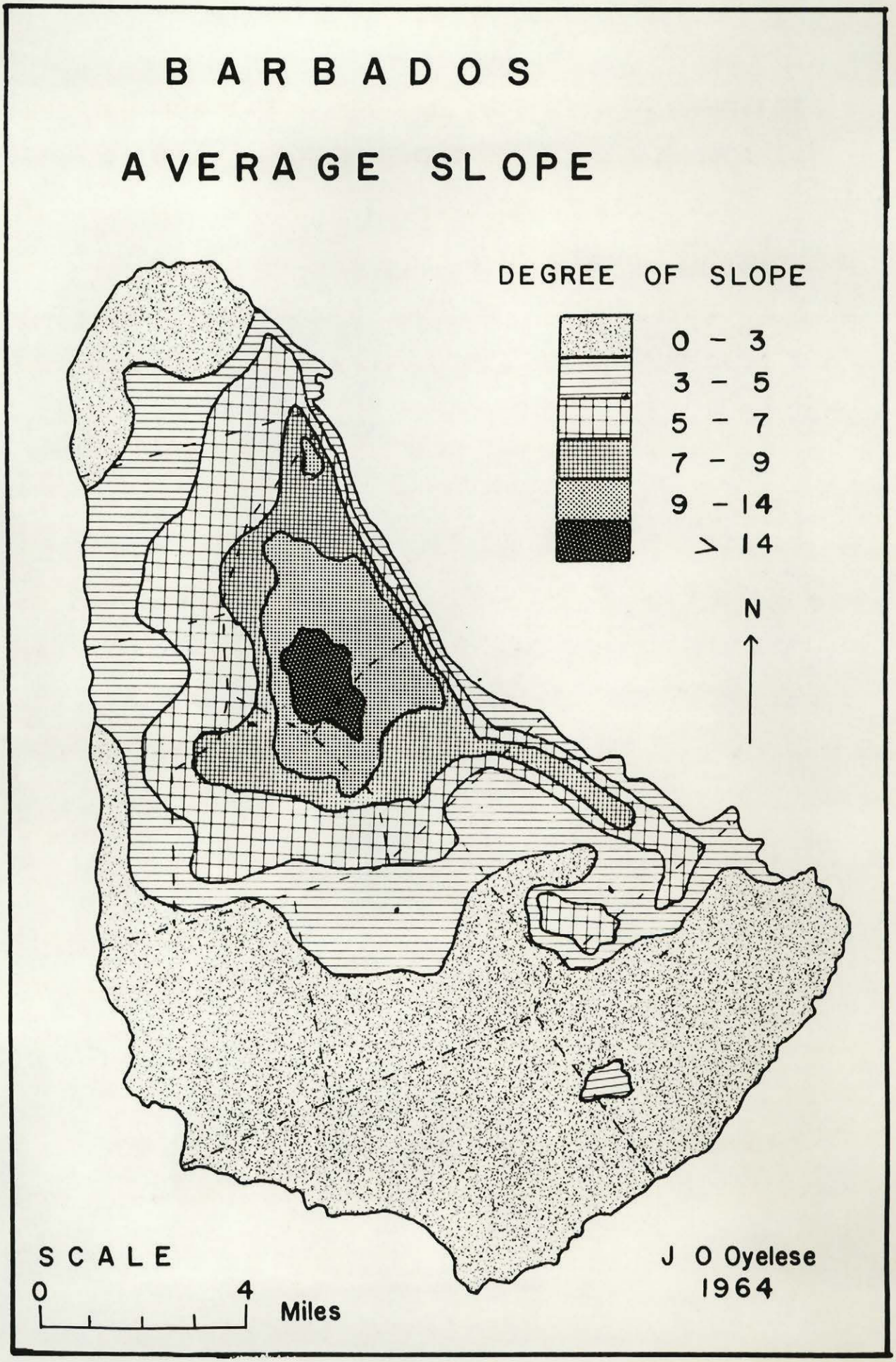

BARBADOS
AVERAGE SLOPE
DEGREE OF SLOPE
0 - 3
3 - 5
5 - 7
7 - 9
9 - 14
> 14
N
SCALE
0
4
Miles
J O Oyelese
1964

Figure 6

feet at the foot of the third cliff away from the coast and its maximum width is about 20 feet. The vegetation appears luxurious and this seems to confirm the suggestion that the soils found at the bottom of the gullies are fertile. This gully widens out on the terraces between the third and the second cliffs but deepens considerably at the second cliff. After this cliff, it becomes very shallow and a variety of fruit trees grows in it.

The gullies are very well sheltered areas with more favourable water conditions and this may account for the many kinds of fruit trees associated with them. These sheltered areas might be of some significance in the cultivation of fruit trees on the island if their potentialities were to be investigated.

The Scotland District:- The Scotland District is comparatively more broken up than the Coralline Limestone District. It resembles a great amphitheatre with steepening concave slopes which lead to the vertical cliff of the coral rocks overlooking most of it. There is hardly any extensive area of flatland in the District and the only flat areas are found at the lower reaches of the so-called valleys of the intermittent streams. It is an area of very steep slopes, some of which have gradients of over 30°. The District as a whole has slopes averaging over 14° (Fig. 6). Under such a situation, one could expect the erosion hazards to be quite considerable. The vulnerability of this area to accelerated erosion has been revealed in several parts of the

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District, especially in the northeast coastal area where the land has been stripped bare of the soil cover.

THE SOILS:[1]

The soils of Barbados were derived from a parent material of Coralline Limestone over about 6/7 of the island, and from the Scotland and the Oceanic Series over the remaining 1/7 of it. These soils have been greatly altered by two main external factors, the first of which is the large quantity of volcanic ash transported from the neighbouring island of St. Vincent early in the century. Price, E. T.[2] stated that about 3.9 and 3.5 tons per acre of volcanic ash were transported this way in 1902 and 1903 respectively, from the Soufriere eruptions on St. Vincent island. The second external factor that has altered the true nature of the soils is the great amount of fertilizers and animal manure that have been added to the soils for hundreds of years.

In spite of these external influences, however, the effects of the nature of the parent materials are still evident in the chemical composition of the soils. For example, the soils of the Coralline Limestone areas are basically alkaline as revealed in the pH content which is greater than 7 in

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1. The material on Soils is mainly from the field notes of Caroll, D. and the "Coral Limestone Soils of Barbados", by Saint, S. J. - Agricultural Journal, Vol. 3, No. 3, 1934.
2. Price, E. T. - "Notes on Geography of Barbados; Field work report, University of California, 1938" - Journal of BHMS, Vol. 29, No. 4, p. 139, 1962.

Plate I

The alluvium covered bed of St. Andrew stream. The bed of the river could be used for vegetable gardening during the dry season. At present, it is only used for rough grazing. There is still enough water in the stream for irrigation if necessary.

Plate II

An old woman gathering wild fruit in a gully near Gregg farm in St. Andrew. The fruit trees that can be identified in the photograph include mango in the background on the left, guava and cashew on the right, and fat-pork in the foreground.

almost all the areas. An understanding of this inherent nature is therefore necessary if the potentialities of the soils are to be used to their optimums.

The Coralline Limestone Soils:- The soils in this group are derived from the Coralline Limestone, but in spite of this, they are not in any way homogeneous, except perhaps in their pH content. The Red Sand soils found on the leeward side of the island in a narrow strip is the only soil in this area derived from another parent material, namely, sand. The soils derived from the Limestone are generally heavy soils with a high clay content, and varying in colour and organic contents, depending on their situation on the island. The soils of the higher parts of the island, i.e. areas above 500 feet are either Red soils or Intermediate Red soils, and they are supposed to contain a larger porportion of organic matters, humus and root residues. The Black soils of the lower areas, on the other hand, are more deficient in organic materials although they contain more silicates of calcium and magnesium. It is also believed that the soils of the higher areas are older than those of the lower areas.

An important characteristic of these soils which could affect cultivation is their depth. Price, E. T. [1] stated that they rarely develop to a depth greater than 2 or 3 feet. While this is generally true, areas like the St. George Valley, the Sweet-water Valley, and some of the filled-in

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1. Price, E. T. - Op. Cit. p.139

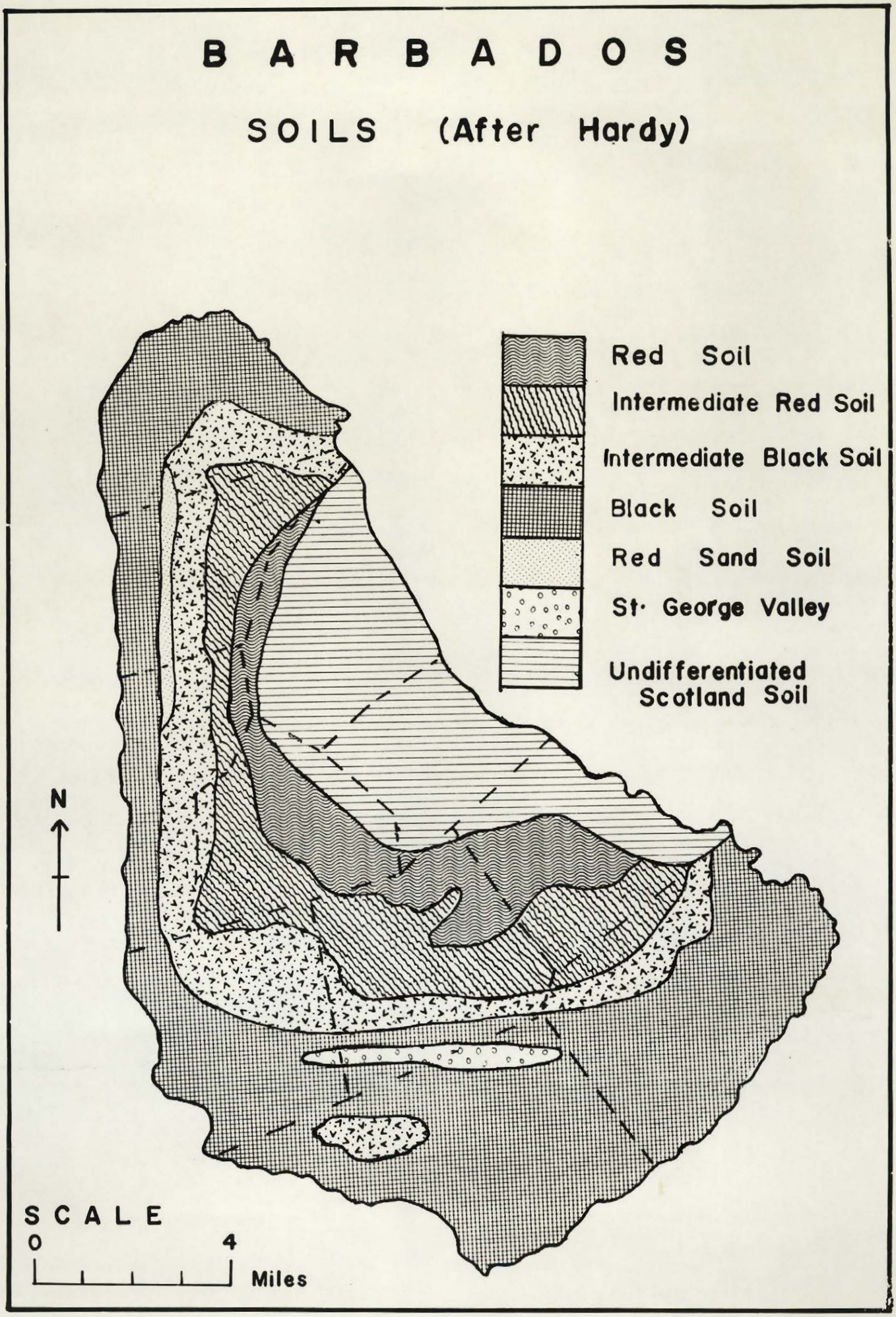
B A R B A D O S
SOILS (After Hardy)
Red Soil
Intermediate Red Soil
Intermediate Black Soil
Black Soil
Red Sand Soil
St. George Valley
Undifferentiated Scotland Soil
N
SCALE
0
4
Miles

Figure 7

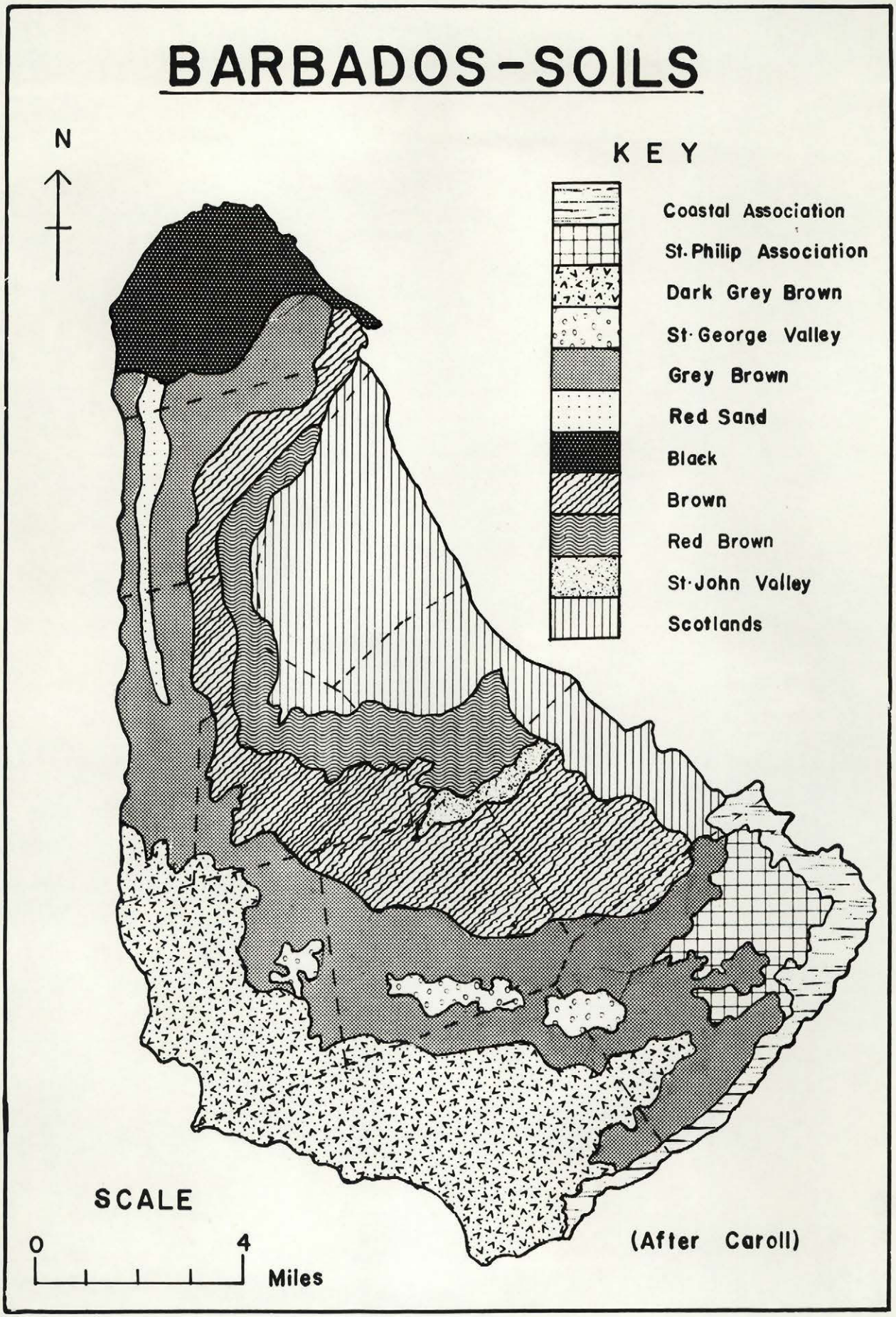
BARBADOS-SOILS
N
KEY
Coastal Association
St. Philip Association
Dark Grey Brown
St. George Valley
Grey Brown
Red Sand
Black
Brown
Red Brown
St. John Valley
Scotlands
SCALE
0
4
Miles
(After Caroll)

Figure 8

depressions could have much deeper soils. Stoniness is another factor to reckon with in the Coralline Limestone areas of the island. For example, the northeastern part of the Parish of St. Lucy is very stony and there are large areas where the base rocks are exposed on the surface. The soils of the southern part are also generally stonier than the soils of the higher elevations, but this stoniness may be a reflection of their immaturity.

Soil Surveys and Descriptions:- The first report on the Coralline Limestone of Barbados was published by Saint, S. J. in 1934. Another survey of the soils was carried out between 1962-63 by Caroll, D. and the detailed report is still expected. The preliminary report has thrown some light on the nature of the soils of the island as they may affect crop cultivation. Both of the soil classifications agree in broad outline on the variations in the colour of the soils according to elevations although the colours assigned to the detailed groupings vary (Figs. 7 & 8).

The soils found on areas above 500 feet, according to Caroll, are the Red Brown associations and the Brown associations. These soils lie over a parent material of Coral Limestone. They contain a larger amount of clay, according to Saint about 70%. They behave, however, as if they contain less colloidal matters and therefore resemble loam. They are more easily worked after rains than soils of the lower elevations. There is easy root access in the soils up to about 12 ins. on the average; below this depth, the

root access is only moderate. The soils vary in thickness on the terraces, being thicker in the higher parts and thinner on the lower parts close to the cliffs. The bed-rock lies at a depth not exceeding 40 ins. on the upper sections of the terrace but gradually reduces to 10 ins. towards its lower section. As a result of the soils' loamy nature, the drainage is fairly rapid at the surface, becoming moderate at a depth of about 12 ins. This is probably why the soils are quickly affected by drought conditions. The slopes common within the area vary from 2^{o} to 20^{o}, but the areas of the steep gradients are only limited to the higher elevations and the cliff lines. Over 50% of the areas covered by these soils comprise flatlands and as such there are no serious erosion problems. The soils here, as a rule, are less stony than on the lower elevations, but several pockets of stoniness may be found generally associated with rock outcrops.

The Intermediate Black soils and the Black soils groups in Saint's classification correspond with five groups in that of Caroll's. These five groups are:- (i) The Grey Brown associations which occupy a fairly large part of the Intermediate Black soils and Black soils area; (ii) The Dark Grey associations, found mainly in Christ Church and St. Michael Parishes, nearest to the coasts; (iii) The St. Philip association which occupies the central part of that Parish; (iv), The Coastal association, mainly found east of St. Philip association next to the coast; and (v) The Black association which occupies most part of the parish of St. Lucy.

All these soils have a parent material of Coralline Limestone but they vary quite considerably in colour, hydrological nature, and to some extent in texture. The northern portion of the Dark Grey soils is situated on the Christ Church Ridge between altitudes of 200 to 400 feet. These soils have a greater clay content than those on the lower elevations and are said to be Montmorillonite clay, characterized by swelling and shrinking. The sub-soil is almost structureless and impedes root penetration after the first wet season following cultivation. The bed-rocks are usually between 24 and 40 ins. below the surface although out-crops are found in some areas. The soil drainage is moderate up to a depth of 10 ins. but slows down at greater depths. There may be a perched water table at depths of 2 to 5 ins. in some areas during the wet season. The areas of the soils have moderate gradients although there may be isolated cases of slopes reaching 20^{o}. Stoniness in the soils also varies from place to place. Most parts are stony, however, and this may tend to rockiness in a few areas. The danger of erosion is only moderate in the areas covered by this soil group.

The Grey Brown group contains colluvium from the higher slopes. They also partake of adjacent soils[1] characteristics in some areas, such as those near the Red Sand soils, containing mixtures of Red sands. The Coastal association found mostly along the coast of St. Philip is a dry soil primarily due to the low rainfall. The soils are also not well developed and are affected by salt sprays. The area is conspicuous for its sour grass

pastures. The St. Philip association is mainly a shelly marl which may also contain a great deal of Oceanic debris. These soils tend to be impermeable and this leads to ponding back of rainwater which results in drainage problems during the wet season. The drainage in the Grey Brown soils is moderate, but drainage is very rapid within the Coastal association. Within both soil groups, there is little or no erosion problem because of the low gradients.

The St. John association is found between the Red Brown and the Brown soils of the higher elevations. The parent material is probably Old Lagoon materials weakened with colluvium. The subsoil is a compact mottled clay and it occurs at depths of 15 to 18 ins. This rich soils covers an area of about 7 miles in length and it is fairly deep with moderate drainage. The gradient of land is not greater than 10^{o} in any part of the area and there is therefore very little danger of erosion. The soils are also free from stoniness.

The St. George Valley soils are found mainly in the Parish of St. George but patches of them extend into the eastern part of St. Michael and the western part of St. Philip. The parent material is probably Old Lagoon material plus some colluvium. The soils are clayey with glazed, very poorly structured subsoil, limiting root penetration to a depth of 10 ins. in some areas. These soils are usually deep but because of the poor structure of

the subsoil, they are apt to become water-logged during the rainy season, thus causing drainage problems. The gradient of the land is not greater than 4^{o} in any place and there is therefore little danger of erosion.

The Red Sand soils are found over a long narrow area on the leeward side of the island at an altitude of between 100 and 300 feet. Although they are found over Limestone, they are formed mainly from the overlying red sands. The subsoil is a very compact, almost structureless, sandy clay below a depth of 15 ins. Roots are partially impeded by this deterioration in the subsoil. The Red Sand soils have the least clay content of all the soils on the island. The drainage is extremely rapid, and crops therefore suffer from extreme drought during the dry season. The gradient of the land varies between 2^{o} and 10^{o}, thus there is very little danger of accelerated erosion except in places where the soils are exposed.

The soils of the Coralline Limestone areas of Barbados are on the whole suitable for cultivation in most parts, but some facts about their depths, their compositions and their drainage, have indicated some problems which the farmers may have to face in their cultivation. The main obstacle to cultivation on these soils seems to be that of moisture supply. As has been indicated some of the soils have rapid drainage while on others it is impeded. The application of fertilizers and manures over hundreds of years has modified greatly the natural composition of the different soils and if adequate

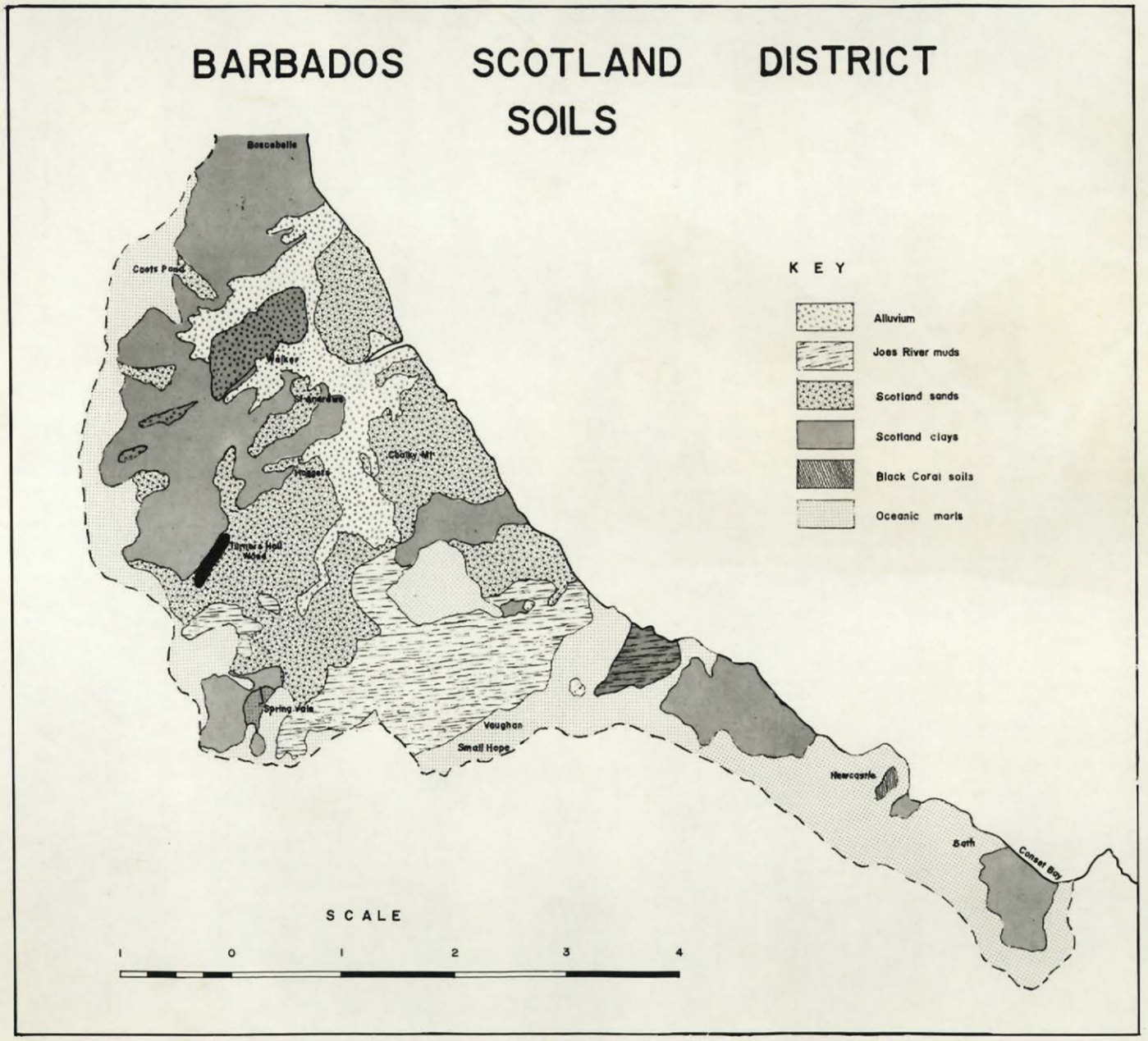
BARBADOS SCOTLAND DISTRICT
SOILS
Boscobelle
Coots Pond
Walker
Clarke Mt
Vaughan
Small Hope
Newcastle
Bath
Conset Bay
KEY
Alluvium
Joes River muds
Scotland sands
Scotland clays
Black Coral soils
Oceanic marls
SCALE
1 0 1 2 3 4

Figure 9

moisture is available, nearly all the soils of the Coralline Limestone areas could be made productive. The extent to which the inherent nature and character of the soils have influenced the distribution of the various food crops cultivated on the island will be further discussed in the next chapter.

The Soils of the Scotland District:- The soils of the Scotland District are varied and may be considered under five broad groups, namely:- (i) the Joes River muds, (ii) the soils of the Oceanic formations and similar materials, (iii) the soils from Scotland Sandstones, (iv) the soils from the Scotland Clays, and (v) the Colluvial soils. (Fig. 9)

The Joes River Muds are found predominantly in the southern end of the district. They are uniformly dark coloured, oil saturated, fine textured sandy clays of mixed mineralogy. The beds are highly erosive and the streams have carved out steep V-shaped slopes. The soil drainage is imperfect and the moisture retaining capacity of the soils is from low to moderate. The soils are not at all stony but the high gradients of between 15^{o} and 30^{o} make them highly susceptible to accelerated erosion. Land-slip is not common in these areas but most of the black soils covering the surface are eroding fast and preventing plant growth. The soils are suspected to be susceptible to shrinkage.

The Oceanic formation includes a great diversity of geological materials. As a result the Oceanic soils, whatever their origin, are neutral if not

weakly calcareous in reaction. Several sub-groups are recognized within the series but the leached, slightly calcareous silt clay soils, brown in colour, overlaying the Oceanic marl form the most important of the sub-groups. They are, however, deficient in phosphate and potash. The lower areas are occupied by the red-brown clay soils which are more heavily leached. The soils are, on the whole, well drained but the most important group is poorly drained and the moisture supplying capacity is moderate. The dominant slopes in these areas are between 10^{o} and 30^{o}, but the lower areas are less steep. The danger of erosion is quite considerable and land-slips are not unknown.

The soils derived from the Scotland Sandstones are found mainly along the north east coast, with a few patches in the central area. They tend to be acid and very variable in texture. The overall soil drainage is rapid and moisture supplying capacity of the soils is low. The dominant slopes in the areas of these soils vary from 15^{o} to 30^{o} and the rate of erosion is therefore moderately high. The soils are also usually stony.

The Scotland clays occupy the whole of the northern part of the Scotland District. They are also found in the central part north of Turners Hall Wood and there are small patches in the south. The soils are mainly greyish silts clays of mixed mineralogy. They are naturally poorly drained and are easily eroded. It is in this area that the worst type of soil destruction is

found in the Scotland District. The dominant slopes of between 15° and 30° coupled with the unconsolidated nature of the soils contribute to the rate at which the soils are eroded. Consequently the problem of soil conservation is most acute in this area, which is a big challenge to the Soil Conservation Authorities of Barbados. The moisture retaining capacity of the soils is also low but it is free from stoniness. The soils could be made productive in areas where erosion has not occurred, by the addition of lime or marl, as they are rich in phosphoric and sulphoric anhydride and potash.

The Colluvial soils are formed by the materials transported by gravity and rain-wash rather than by the underlying rocks. These soils consist of raw soils which are constantly being added at the surface and the deeper, more mature soils below. The top horizon of the Colluvium soils are thicker and not much eroded, consequently, they have greater fertility. These soils are found in the valleys and the alluvial flats of the District.

The soils of the Scotland District are less productive than those of the other parts of the island. The greater slopes found in this District encourage accelerated erosion and there are also land-slips in some parts. The rate of erosion is further heightened by the inhabitants who overgraze the sandy hills with their sheep and goats. Unlike the other parts of the island where the soil factors are not a serious obstacle to cultivation, the poor nature of the soils, or lack of soil cover, in the Scotland District coupled

with its rugged, broken and highly eroded relief constitute a major set-back to cultivation.

THE CLIMATE:

The four major climatic elements affecting the growth of plants are:- temperature, rainfall, amount of sunshine, and the direction and force of the prevailing winds. Of all these, rainfall is by far the most significant as far as the cultivation of food crops in Barbados is concerned.

Plant life depends on the amount of moisture available for its use in the soil, and the amount of moisture in turn depends on the effective rainfall. The usefulness of the rainfall, however, is closely linked with the mode of incidence and also the period during which it falls. The greater part of Barbados receives its rainfall during the months of June to December, although in some areas it extends into January. The remaining four or five months of the year are relatively dry although they are not altogether without some rainfall.

Types of Rainfall:- Skeete, C.C.[1] recognized three types of rainfall in Barbados. The first type is the General or Regional rains which occur throughout the island and often throughout neighbouring islands as well. The cause of these rains is probably related to the humid N.E. Trade winds.

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1. Skeete, C.C. - "Barbados Rainfall" - Dept. of Agriculture & Science, Pamphlet No. 9, 1931.

These rains are of special importance to the eastern parishes of St. Philip, (the southern part of) St. John, and the eastern part of St. Michael, as they receive very little of the other types of rainfall. The second type is the Convectional rains which are said to occur at least once in each month and usually more often from July to November. This is the period when there is a combination of high temperatures, high humidity and low wind velocities on the island. The third and rarest type is the cyclonic rains associated with the tropical cyclones, the strongest of which are referred to as hurricanes. These rains are heavy, generally associated with very strong winds, and are likely to do more damage through flooding and soil wash than any good. They are therefore of little value as far as cultivation of crops is concerned.

Rainfall Distribution:- The distribution of rainfall on the island shows some correlation with its orography. The lowest rainfall of 44 to 51 ins. is found in areas which are less than 200 feet above sea level. There is an intermediate zone with heights between 200 and 800 feet where rainfall ranges from over 51 to 80 ins. The areas with altitude above 800 feet have an annual rainfall of over 80 ins. The distribution of rainfall also shows some variation from the eastern (windward) coast to the western (leeward) coast. One would, as a rule, expect rainfall to decrease considerably as the leeward coast is approached, but as a matter of fact, certain parts of the leeward coast receive more rainfall than the windward coast.

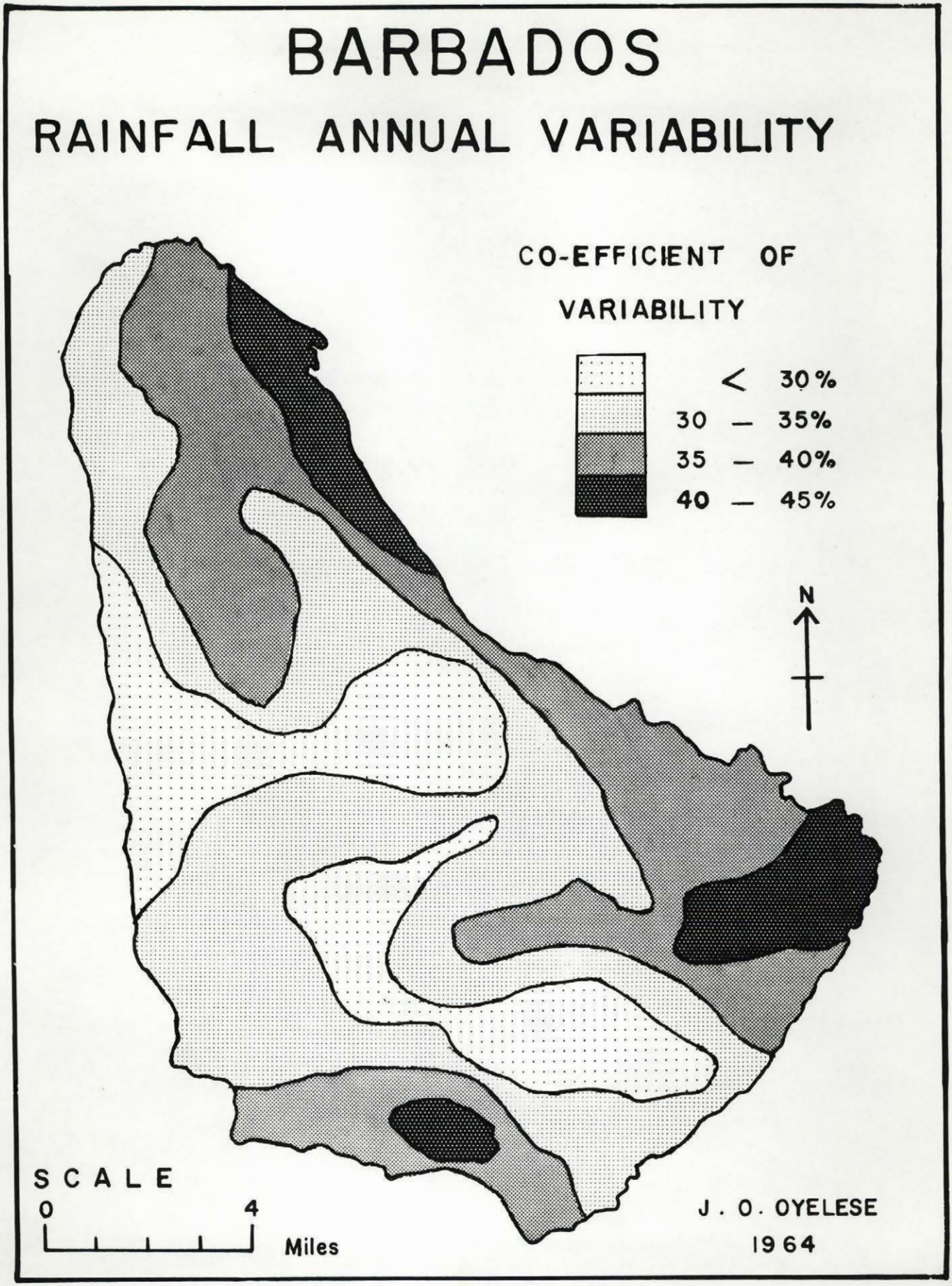
BARBADOS
RAINFALL ANNUAL VARIABILITY
CO-EFFICIENT OF VARIABILITY
< 30%
30 — 35%
35 — 40%
40 — 45%
N
SCALE
0
4
Miles
J. O. OYELESE
1964

Figure 10

Annual Variability:- The amount of rainfall received in Barbados varies from year to year. There had been years of very little rainfall which led to crop failures and there had also been years of excessive rainfall. A consideration of the rainfall variability by the writer over a period of about 25 years (1933-1957) reveals some pattern which could probably be used as an index of rainfall reliability all over the island on an annual basis. The coefficient of variability thus obtained reveals that the percentage variability tends to be highest along the windward coastal areas and part of the southern areas of the island (Fig. 10). The percentage variability is lowest on higher elevations within the area roughly bounded by Claybury, Fisher Pond, Castle Grant and Lion Castle, the low lands along the St. George Valley and the Central portion of the leeward coast. A high coefficient of variability probably indicates that the rainfall in such areas is not reliable and a low coefficient of variability probably indicates that the rainfall is fairly reliable, although this is not always true.

Monthly Distribution:- The distribution of rainfall from month to month within a year and the mode of incidence during each month is far more important to the cultivation of food crops generally requiring a short growing season. A clear understanding of this distribution is of real importance to the study of food crop cultivation on an island like Barbados where the rainfall distribution could be very local. It is a common occurrence for an area to receive as much as 2 to 3 ins. of rain in a short spell while other areas

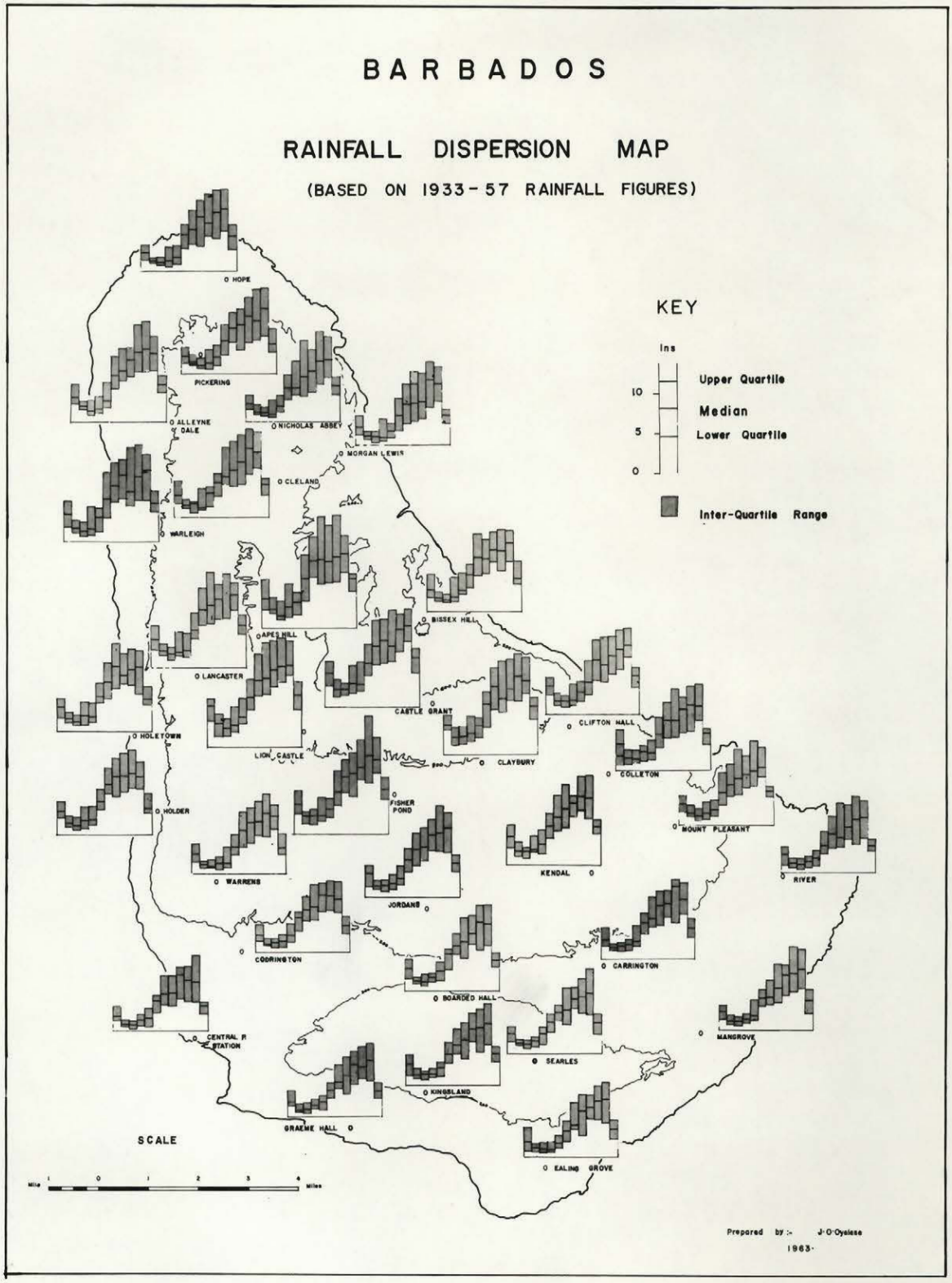
BARBADOS
RAINFALL DISPERSION MAP
(BASED ON 1933-57 RAINFALL FIGURES)
KEY
Ins
10
5
0
Upper Quartile
Median
Lower Quartile
Inter-Quartile Range
HOPE
PICKERING
ALLEYNE DALE
NICHOLAS ABBEY
MORGAN LEWIS
CLELAND
WARLEIGH
BISSEX HILL
APES HILL
LANCASTER
HOLETOWN
CASTLE GRANT
CLIFTON HALL
LION CASTLE
CLAYBURY
COLLETON
HOLDER
FISHER POND
MOUNT PLEASANT
WARRENS
KENDAL
RIVER
JORDANS
CODRINGTON
CARRINGTON
BOARDED HALL
CENTRAL P STATION
MANGROVE
SEARLES
KINGSLAND
GRAEME HALL
EALING GROVE
SCALE
Miles 1 0 1 2 3 4 Miles
Prepared by :- J.O'Oyelese
1963.

Figure 11

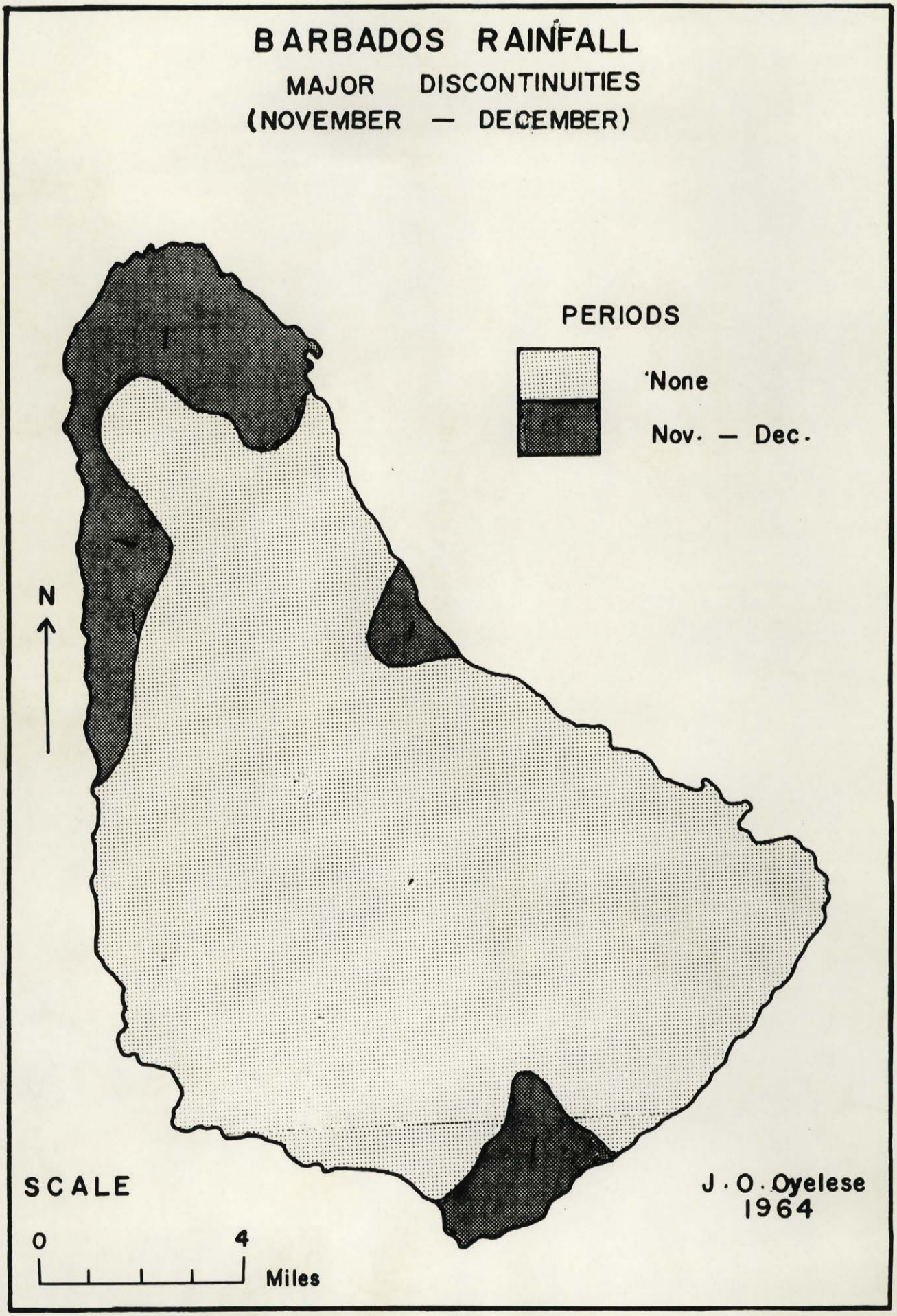
BARBADOS RAINFALL
MAJOR DISCONTINUITIES
(NOVEMBER — DECEMBER)
PERIODS
None
Nov. — Dec.
N
SCALE
0
4
Miles
J. O. Oyelese
1964

Figure 12

may not receive any. The amount of rain received during seed germination, maximum foliage and the period of seed formation are all very important for the optimum yield of crops.

Fig. 11, which shows the rainfall dispersion on the island, is based on the averages for a period of 25 years (1933-1957). The writer has made use of the Median and the Lower and Upper Quartiles to determine the level of significance of the monthly distribution of rainfall in various parts of the island. It should be acknowledged, however, that the results obtained are only suggestive since the number of weather stations used is limited to only thirty-two. Nevertheless, certain patterns of dispersion are revealed at a glance. It can be observed, for example, that there is a general decrease in the amount of rainfall received on the island from January to a minimum in March. This decrease actually starts from November, but the break between November and December is a clear one in most parts of the island, with the exception of a narrow belt on the leeward coast extending to the north, and another small patch on the northern coast. (Fig. 12) This break is usually interpreted as the start of the dry season, but the month of December is still wet enough to be regarded as part of the rainy months in some parts of the island.

A number of minor discontinuities can be recognized all over the island at two main times of the year. The first is a series of negative discontinuities which occur between January and March, although limited to

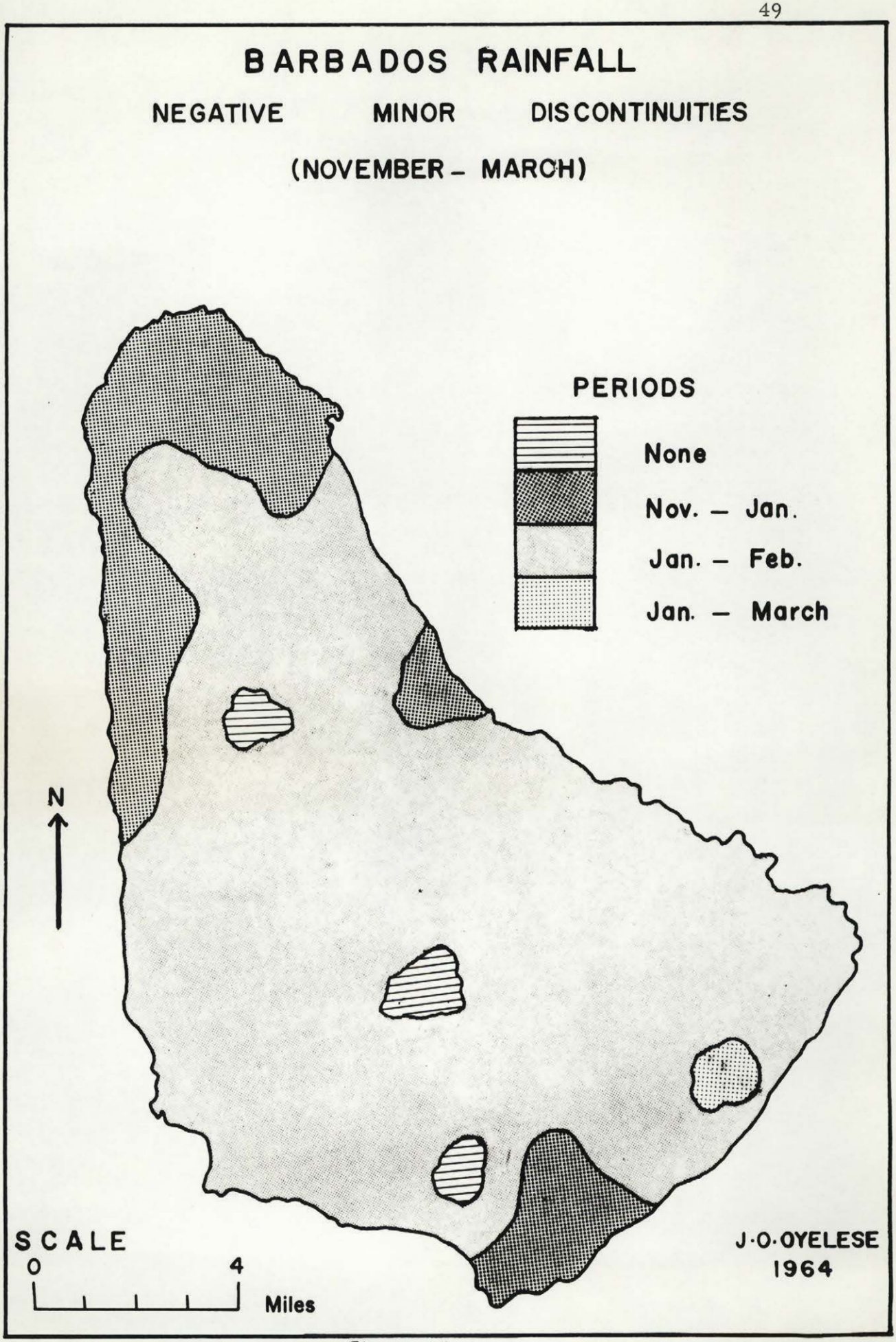
BARBADOS RAINFALL
NEGATIVE MINOR DISCONTINUITIES
(NOVEMBER – MARCH)
PERIODS
None
Nov. – Jan.
Jan. – Feb.
Jan. – March
N
SCALE
0
4
Miles
J·O·OYELESE
1964

Figure 13

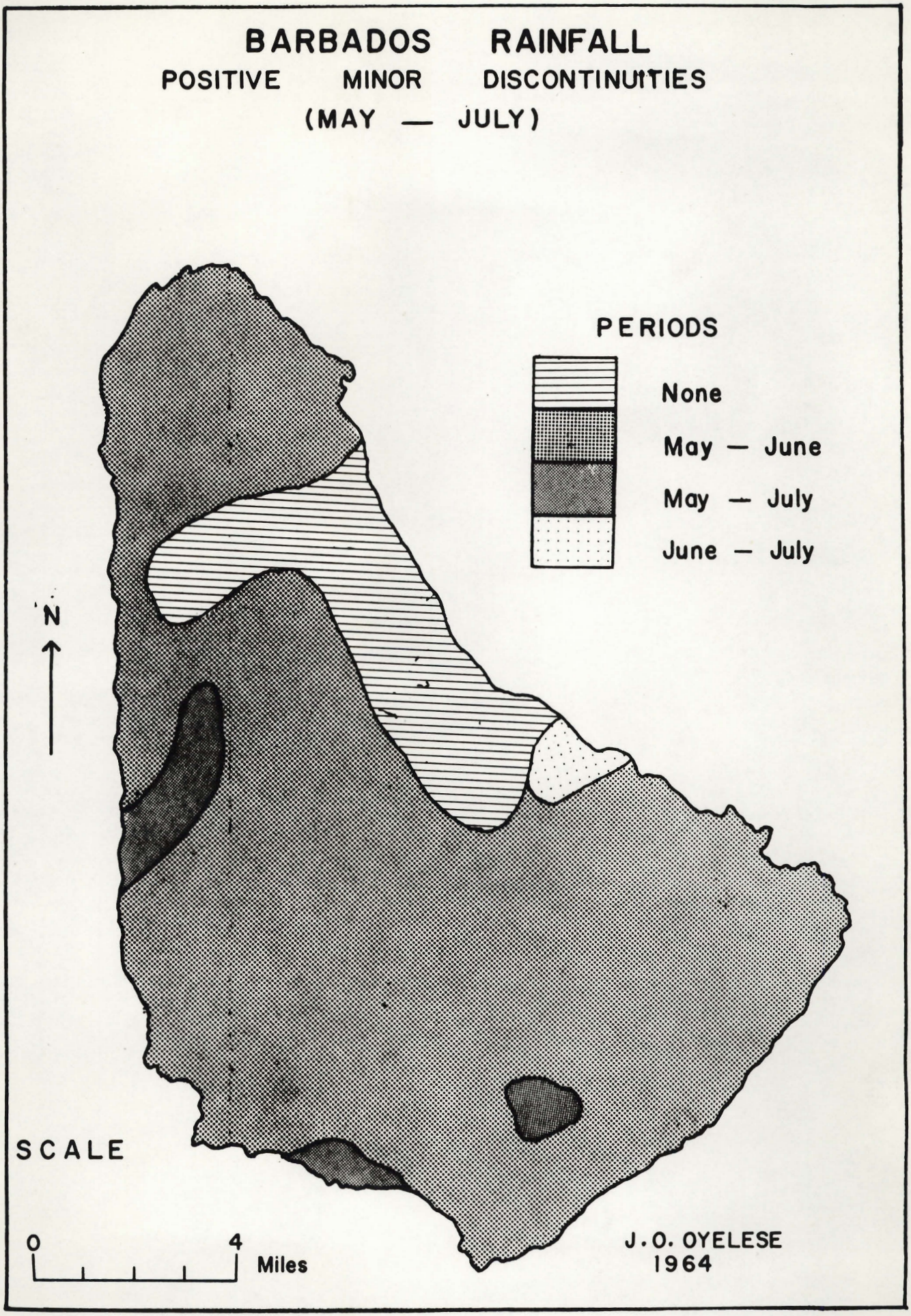
BARBADOS RAINFALL
POSITIVE MINOR DISCONTINUITIES
(MAY — JULY)
PERIODS
None
May — June
May — July
June — July
N
SCALE
0
4
Miles
J.O. OYELESE
1964

Figure 14

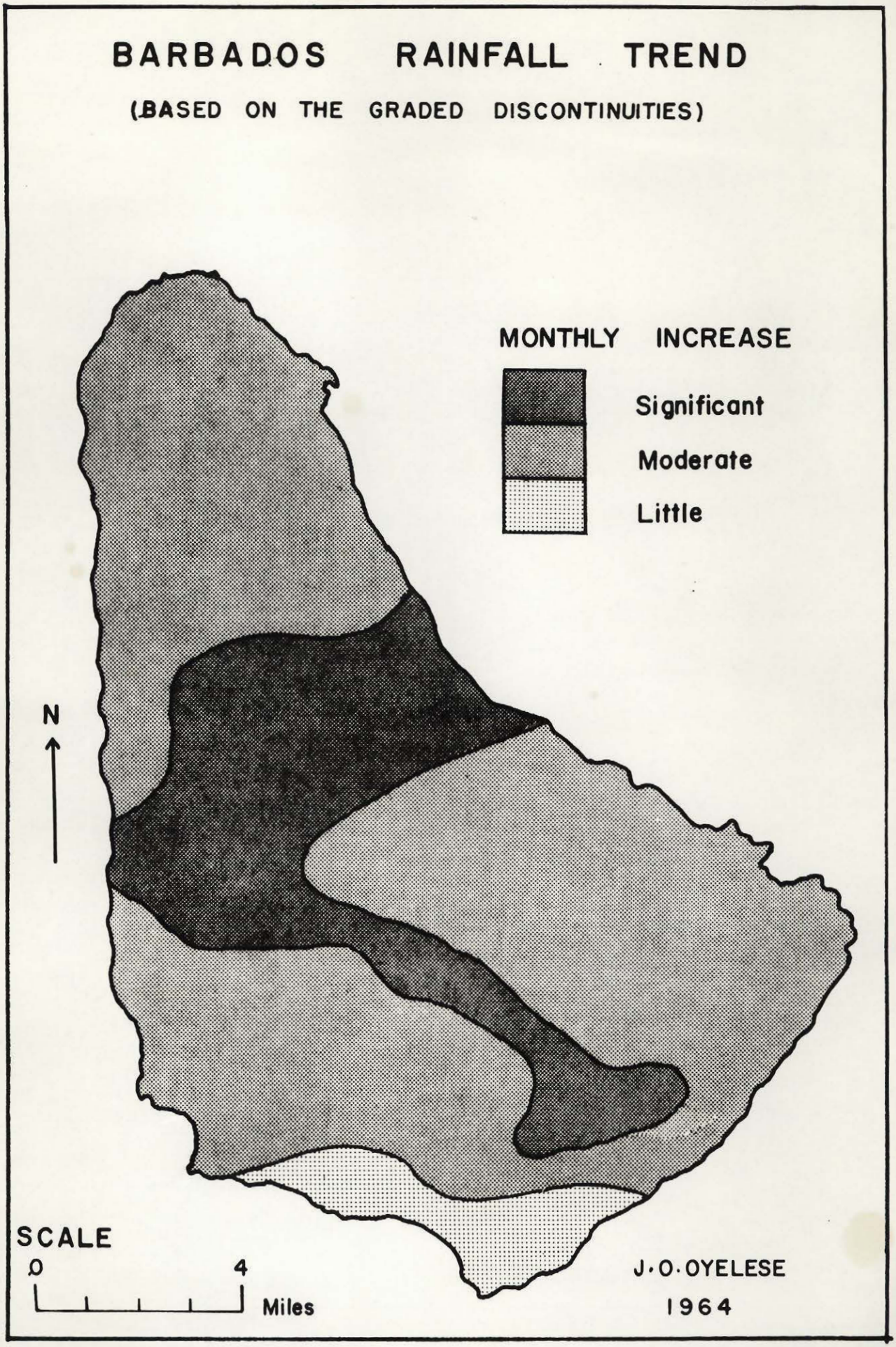
BARBADOS RAINFALL TREND
(BASED ON THE GRADED DISCONTINUITIES)
MONTHLY INCREASE
Significant
Moderate
Little
N
SCALE
0
4
Miles
J.O.OYELESE
1964

Figure 15

February in many parts of the island (Fig. 13). This is probably the most critical period for crops, and vegetative growth is made almost impossible without irrigation. The second period of discontinuity occurs in May and June, when the breaks are positive, i.e. they indicate a gradual increase in the amount of rainfall (Fig. 14). This period is regarded as the start of the rainy season. The graded breaks occurring between May and August probably emphasize the gradual increase in rainfall on the island until a peak is reached around October and November. There might be a minor drop in the amount of rainfall in most areas during September, but this does not necessarily indicate that two rainy seasons could be recognized as this drop is not significant. There is a tendency for the rainfall to increase significantly from month to month during the early part of the rainy season along the central part of the island and a narrow belt extending towards the southeastern part. The extreme south of the island shows little or no increase during this period while the rest of the island shows some increase for a short period (Fig. 15).

The relative wetness and dryness of the different periods of the year is another aspect probably indicated in the figure showing the rainfall dispersion. If, for purposes of assessing minimum water requirements of food crops, a Lower Quartile rainfall of 4 ins. is taken as indicating a month wet enough for maximum plant growth, the number of such months would be distributed over the island as shown in Table 1. A corresponding figure

Table 1

Distribution of Wet Months and Dry Months
(Wet Months:- L.Q. > 4"; Dry Months:- L.Q. < 1")

Weather Station & Parish	Altitude	Location	Wet Months	Dry Months
Graeme Hall (Christ Church)	200	S.	3	3
Ealing Grove (Christ Church)	"	S.	3	5
Hope (St. Lucy)	"	N.	3	4
Central P. Station (Bridgetown)	"	S.W.	1	3
Codrington (St. Michael)	"	S.W.	3	3
Mangrove (St. Philip)	"	S.E.	3	4
Holder (St. James)	"	W.	5	3
Holetown (St. James)	"	W.	5	4
Carrington (St. Philip)	"	E.(C)	5	4
River (St. Philip)	"	E.	3	5
Kingsland (Christ Church)	200-500	S.	4	2
Searles (Christ Church)	"	S.	4	2
Boarded Hall (St. George)	"	S.(C)	5	2
Jordans (St. George)	"	S.(C)	5	2
Pickering (St. Lucy)	"	N.	2	2
Nicholas Abbey (St. Peter)	"	N.	2	3
Warleigh (St. Peter)	"	W.	5	2
Alleynedale (St. Peter)	"	W.	6	1
Warrens (St. Michael)	"	W.	3	4
Cleland (St. Andrew)	"	C.	4	2
Kendal (St. John)	"	E.(C)	5	1
Mount Pleasant (St. Philip)	"	E.	3	2
Colleton (St. John)	"	E.	5	2
Clifton Hall (St. John)	"	E.	5	1
Morgan Lewis (St. Andrew)	"	E.(N)	2	4
Lancaster (St. James)	500-800	W.	6	1
Fisher Pond (St. Thomas)	"	C.	6	0
Claybury (St. John)	"	E.(C)	6	0
Bissex Hill (St. Joseph)	"	E.	5	0
Apes Hill (St. James)	800	W.(C)	6	0
Lion Castle (St. Thomas)	"	C.	7	0
Castle Grant (St. Joseph)	"	E.(C)	7	0

showing the dry months during which normal vegetative growth is almost impossible is indicated by months having an L.Q. of less than 1 in. Equally striking is the close correlation between areas with longer wet periods and those of highest elevation on the island.

Monthly Rainfall Reliability:- The mean monthly dispersion of rainfall calculated for certain stations selected on the bases of altitude and position on the island (Table 2) probably reveals the amount of reliability that can be expected at different critical periods of the year. The deductions from these figures, however, can only be suggestive as it is based on the average values for only twenty-five years of observation. The figures reveal that the percentage variability for March is fairly high all over the island, except for the higher altitudes where it is relatively low. The percentage variability drops remarkably in June and this trend continues into November when the lowest percentage variability occurs. This percentage increase is also noticeable from east to west. As has been suggested in the case of annual variability, the higher percentage variability probably signifies a lower reliability of rainfall and vice versa.

The ultimate measure of rainfall reliability for the cultivation of food crops is the amount of moisture available in the soil. The soils of the island, as has been mentioned previously, have fairly good moisture-retaining capacity, depending on their locality; the only exceptions being those highly susceptible to drought condition due to inadequate depth of soil or physical

composition, such as the Red Sand soils of the leeward coast and some of the shallow soils of the higher terraces close to the cliffs. Rouse, W.[1] has implied in his thesis that the potential evapotranspiration on the island does not constitute a great obstacle to cultivation in most parts during the wet periods.

Temperature and Light:- The factors of temperature and light in Barbados do not constitute any problem to cultivation. There is lack of extremes in temperature, the range being between 75 to 80°F. The temperature rarely falls below 68°F. or rises above 88°F and the mean daily temperature seldom varies more than 3.9°F. between the warmest and coolest months. Nevertheless there may be local variations in the daily temperature on the island, depending on the altitude and the amount of cloud cover.

The soil's temperature as observed by Rouse, W. also reveals little variation in the mean figures at depths of 2, 4, and 8 ins. The mean annual temperatures of 84°, 82° and 81° respectively were recorded for the above mentioned soil depths. The lowest temperatures of 75°, 73° and 75° were recorded for February and the highest of 95°, 92° and 86° were recorded in May and June. He further indicated the dampening effect of depths on the soil temperature, this tendency being noticeable at depths lower than 4 ins. Above this level, changes in air temperature exert more influence on soil. Although the evidence of this observation is not

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1. Rouse, W. - "The Moisture Balance of Barbados and Its Influence on Sugar Cane Yield" - McGill University, M.Sc. Thesis, 1962.

conclusive due to the limited period devoted to it, yet it seems as if the change in air temperature would have a greater effect on the soils in which food crops grow since most of them have their root system close to the surface.

The amount of light received on the island all the year round is sufficient for plant growth while the effect of cloud cover on the amount of this light is too negligible to have any effect. Cloudiness, however, affects the rate of evaporation which could be significant in some parts of the island.

The relative humidity, with a perennial varation of between 75% and 95%, does not affect plant growth adversely. Daily it varies between about 60% (usually occurring during the hottest part of the day), and 95% (usually occurring in the early morning).

Wind Condition:- The force and frequency of the prevailing winds are important factors in the cultivation of certain food crops on the island. According to Rouse, W.[1], the winds of the island show only a single-cycle regime. Their velocity increases from a low of 7.8 m.p.h. in October to a high of 13.5 m.p.h. in June after which it falls off evenly. The average speed is approximately 11 m.p.h. The effects of the winds are more felt in the higher areas than in the relatively more protected lower areas. The gullies in the limestone areas are the most protected. The winds, as a rule, are not destructive except when they attain the speed of a hurricane. The windiest time of the year is usually during the dry period, and this,

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1. Rouse, W. - Op. Cit.

Table 2

Mean Monthly % Variation of Rainfall - 1933-1957

Weather Station & Parish	Altitude	Location	Mean monthly % variation Mar.	June	Sept.	Nov.
Ealing Grove (Christ Church)	200	South	60	41	25	36
Hope (St. Lucy)	"	North	45	33	43	34
Warleigh (St. Peter)	"	West(N)	62	53	57	33
Morgan Lewis (St. Andrew)	"	East(N)	59	54	52	28
Holder (St. James)	"	West(S)	82	32	32	29
River (St. Philip)	"	East(S)	64	42	38	34
Kingsland (Christ Church)	200-500	South	33	33	25	33
Pickering (St. Lucy)	"	North	71	46	40	37
Warrens (St. Michael)	"	West	60	37	35	21
Mount Pleasant (St. Philip)	"	East	62	50	30	26
Lancaster (St. James)	500-800	West	45	45	25	20
Fisher Pond (St. Thomas)	"	Centre	41	41	30	24
Claybury (St. John)	"	East	28	34	32	25
Apes Hill (St. James)	800	West	79	46	43	26
Lion Castle (St. Thomas)	"	Centre	24	30	30	21
Castle Grant (St. Joseph)	"	East	37	36	42	20

coupled with the greater sunshine, leads to higher evaporation potential.

THE WATER RESOURCES & POSSIBILITIES OF IRRIGATION

The realization that there are certain areas on the island deficient in water for cultivation leads to the question of irrigation possibilities. The possibilities of irrigation, however, depend on the amount of water that is stored in the underground reservoirs (made available by the Coral Rock) as the island is devoid of surface streams, except the insignificant intermittent streams of the Scotland District. Not all the rain that falls is thus trapped; some of it escapes into the sea, but a large quantity is retained as Sheet-water.

According to Senn, A.[1] this Sheet-water is not localised as streams but occurs as a continuous sheet of varying thickness. Near the seashore there is generally a slight infiltration of salt water resulting in brackishness, but this band of brackish water is usually narrow. He estimated that the island has a water reserve of about 45 million gallons per day, but recent investigations into the water resources have proved that the reserve has shown a decrease to between 30 and 31 million gallons per day. The future of irrigation possibilities is made even more doubtful by the greater demand on the water resources made by the rapidly increasing population. It is estimated that the amount of water now being used per day on the island

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1. Senn, A. - "Ground Water Resources of Barbados" - p. 14 March, 1946.

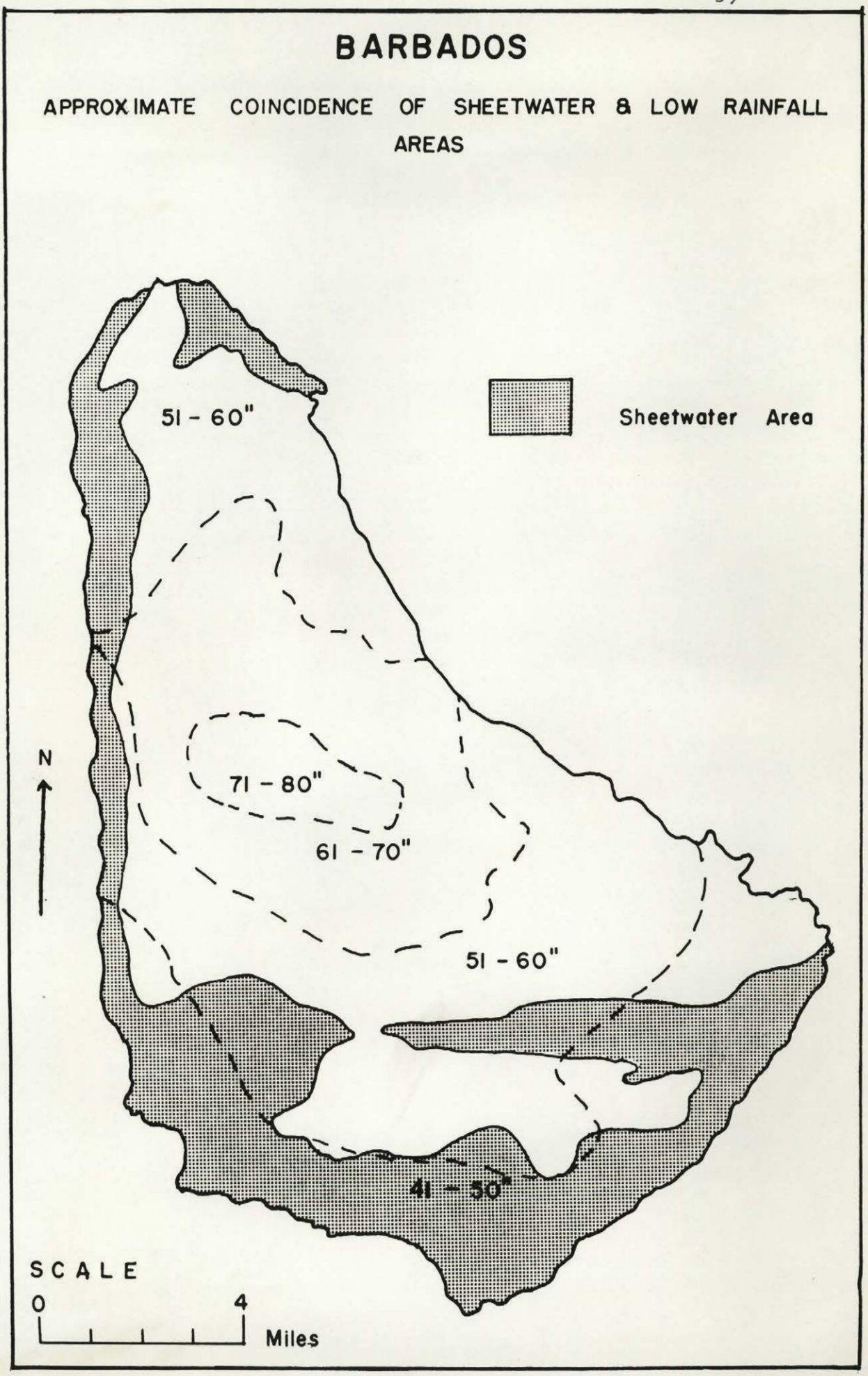
BARBADOS
APPROXIMATE COINCIDENCE OF SHEETWATER & LOW RAINFALL AREAS
51 - 60"
Sheetwater Area
N
71 - 80"
61 - 70"
51 - 60"
41 - 50"
SCALE
0
4
Miles

Figure 16

is about 13 million gallons, and the Government is proposing to increase this daily consumption to about 25 million gallons within the next five years. If this policy is carried out, there may be about five million gallons of water per day left for irrigation and this is far from being sufficient to satisfy the irrigation requirements of the island.

The Sheet-water areas coincide very admirably with the areas of low rainfall and low relief (Fig. 16). The possibilities of irrigation are great, therefore, if there is a clear water policy initiated by the Government. However, there is no clear water policy, at least at the moment, although loans have been given to peasant farmers for the sinking of wells in certain areas. There is the possibility though,that such wells may become dry in the near future due to indiscriminate tapping of the Sheet-water in the absence of a definite water policy.

CHAPTER IV

THE DISTRIBUTION OF FOOD CROPS IN BARBADOS

THE RANDOM SAMPLE SURVEY

A random sample survey of the distribution of peasant agriculture in Barbados was carried out between May and September, 1963, by the writer and another graduate student of the department of geography. The objectives of this sample survey included: (i) obtaining as accurately as possible, the acreage devoted to food crop production on peasant holdings; (ii) a determination of the composition of the crops grown and some measure of their importance in the island's economy; (iii) collecting information about manurial and rotational practices; (iv) obtaining information on storage of crops and irrigation practices on the peasant holdings.

It was decided that for the purpose of the survey, the term food crops would include: (i) ground provisions, which consist of root crops and cereals; (ii) vegetables, which include seasonings; and (iii) fruit trees, which include also the tree crops.

Choice of Sample Units & Collection of Data:- The areas covered by peasant agriculture on the island were determined from Anderson's map (1961)[1],

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1. Anderson, J.R. - Op. cit. - 1961.

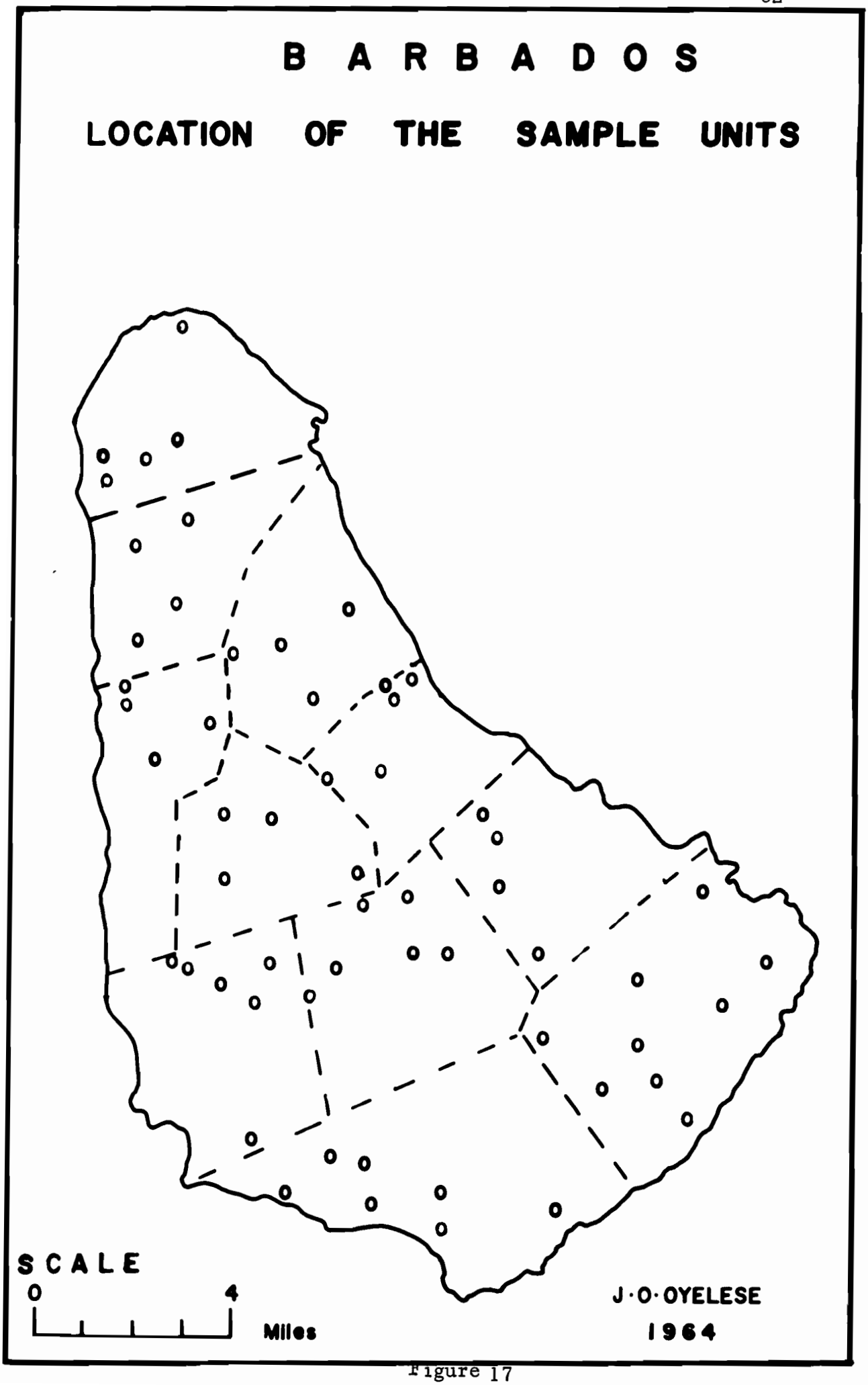
B A R B A D O S
LOCATION OF THE SAMPLE UNITS
SCALE
0
4
Miles
J·O·OYELESE
1964

Figure 17

showing the distribution of peasant agriculture in Barbados. The random sampling covered about 10% of the areas under peasant agriculture so obtained. The island was grided into inch squares and then stratified according to the parishes. The random number table was then used to select 10% of the grided areas within each parish and a total of 58 sample units were obtained. (Fig. 17) Each of these sample units covered an area of about 70 acres. A system of sub-sampling, which involved one holding in every five, was adopted for sampling within each unit.

The collection of data was carried out by the use of a questionnaire supplemented by oral interview. The oral interview was carried out for only two farms within each sample unit, but the questionnaire was completed for each of the farms sampled. It was not possible to obtain yield data on the different food crops because the peasants were reluctant to give any information about their production during the 1962-63 crop season probably due to fear of taxation. The survey therefore depended wholly on the estimation of acreages planted in each crop during the agricultural year.

The Analyses of Data:- One of the aims of the random sample survey was to map the areal distribution of the various food crops cultivated on the island. The total area occupied by each crop within the sub-sample was obtained and expressed as a percentage of the whole area under food crops within the sample unit. The figures thus obtained were weighted with the acreage under peasant holdings in the parish within which the samples fell.

A grand-mean was calculated and by using this grand-mean, a grand-standard deviation was obtained. The grand-standard deviation was used as a basis for comparing the grand-mean and the sample-mean, the idea being to see how the sample-mean varies from the grand-mean. The highest intensity of cultivation was indicated by a positive deviation of more than two standard deviations; the intensity is fairly high with deviation less than or equal to two standard deviations but more than one standard deviation; the intensity is moderate if the deviation is less than or equal to one standard deviation; and the intensity is little or nil if there is no deviation at all above the grand-mean[1].

Limitations:- The writer discovered during the process of analyses that the data obtained from the sample units suggest skewed distributions for all the crops under consideration. It was apparent therefore, that the use of the mean as a measure of central tendency would be open to some questioning. However, it was discovered that a conversion of these data into a normal distribution shows no significant improvement on the distribution patterns of the crops, so that the analysis carried out would be quite adequate for the purpose of mapping their general distributions.

The base map of peasant agriculture used for selecting the sample units was another factor limiting the accuracy of the distribution maps. The map does not show any area under peasant agriculture on the island's predominantly plantation lands, though the writer discovered in the field that within some of these areas the peasants have holdings rented from

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1. It might be noted that those cases where the sample-mean lay below the grand-mean were ignored, only positive deviations were considered important.

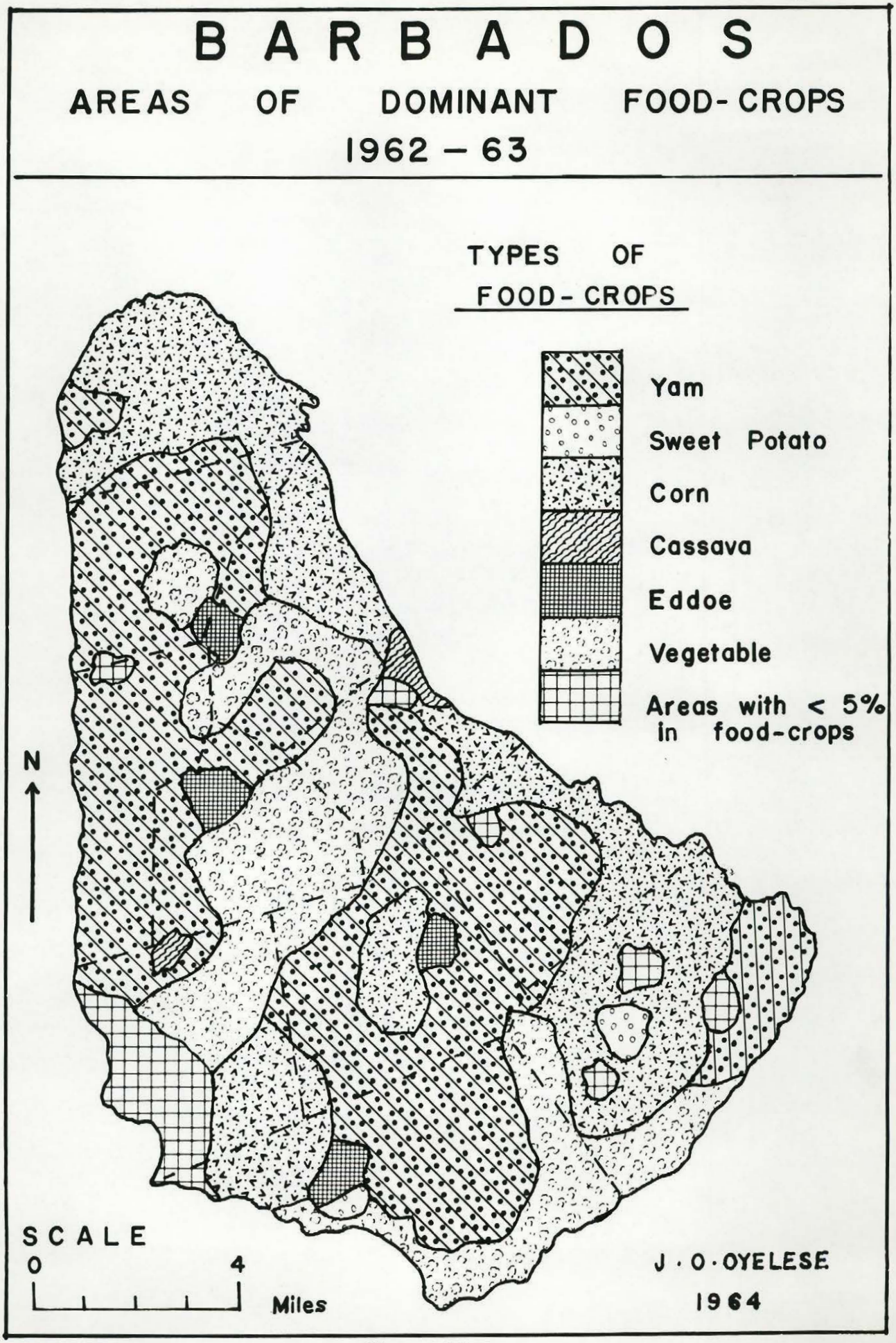
BARBADOS
AREAS OF DOMINANT FOOD-CROPS
1962 – 63
TYPES OF FOOD-CROPS
Yam
Sweet Potato
Corn
Cassava
Eddoe
Vegetable
Areas with < 5% in food-crops
N
SCALE
0
4
Miles
J · O · OYELESE
1964

Figure 18

BARBADOS

DISTRIBUTION OF ACREAGE IN YAM 1962-63

(BASED ON THE DEVIATION OF THE SAMPLE-MEAN FROM THE GRAND-MEAN)

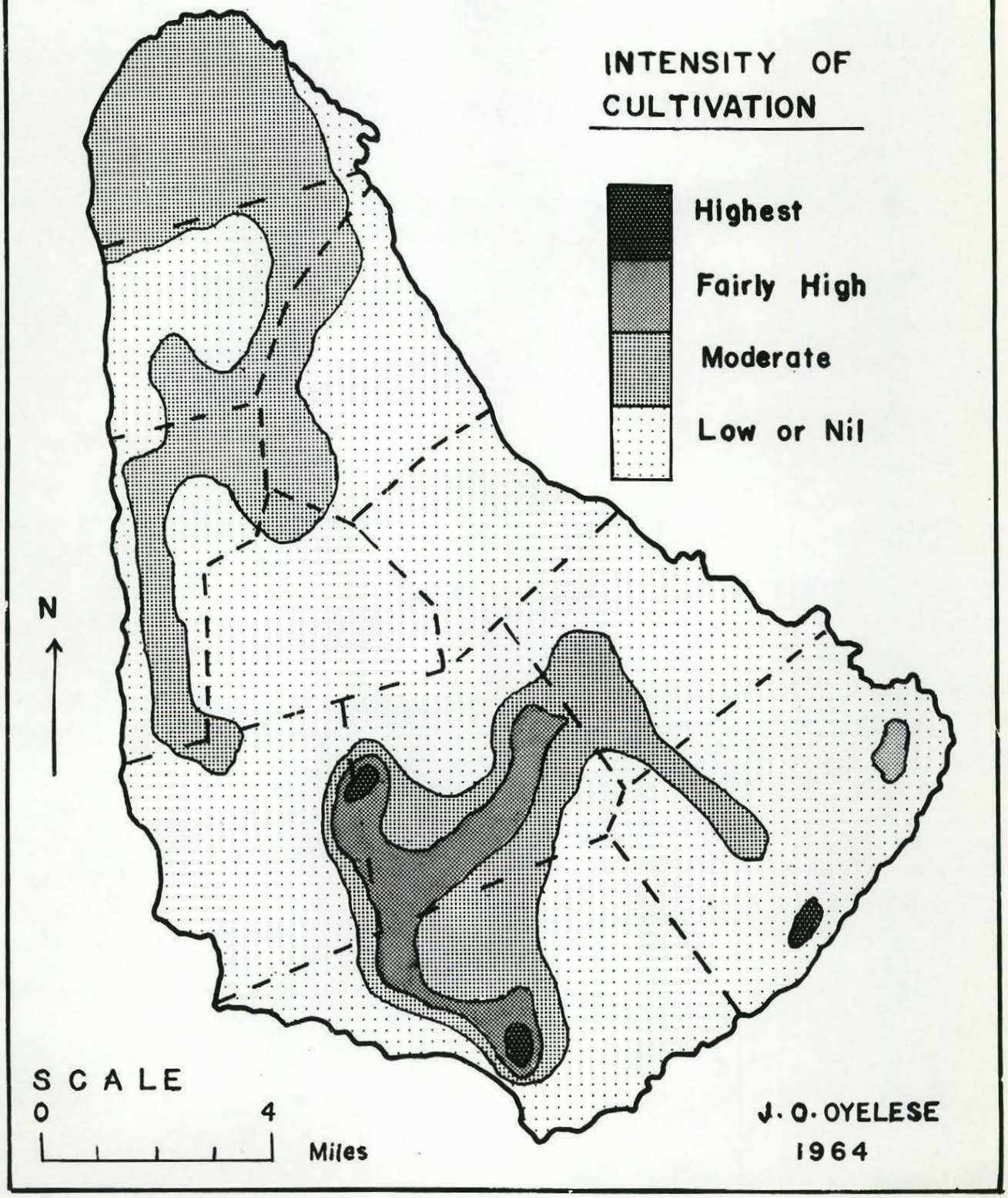

Figure 19

the plantations. This shortcoming could only be rectified by using the adjacent sample units as an indication of possible distribution within the areas and some interpolation had to be introduced in the mapping of the distribution.

All efforts to make yield estimate, both total and per acre, were hampered either by lack of records of yields on the peasant farms, or by their reluctance to make it available for fear of taxation. Nevertheless, the maps showing distributions of food crops based on acreages which have been used in the discussion that follows are fair representations of cultivation distribution on the island during the 1962-63 crop season.

FOOD CROPS DISTRIBUTION ON PEASANT HOLDINGS

The food crops cultivated in Barbados in varying proportions show a widespread distribution, though there are areas of marked concentration and emphasis for some crops (Fig. 18).

Fig. 18 shows that the cultivation of yam is very popular on the island. Its cultivation predominates in most parts of the parishes of St. Lucy, St. Peter, St. James, St. George, St. John, Christ Church and some parts of St. Thomas and St. Philip. The emphasis on cultivation varies within these areas as revealed in the map showing the intensity of cultivation (Fig. 19). The areas with the highest intensity are found in the southern parts of the island, mainly within the parishes of St. George and

BARBADOS

DISTRIBUTION OF ACREAGE IN SWEET POTATO 1962 – 63

(BASED ON THE DEVIATION OF THE SAMPLE MEAN FROM THE GRAND MEAN)

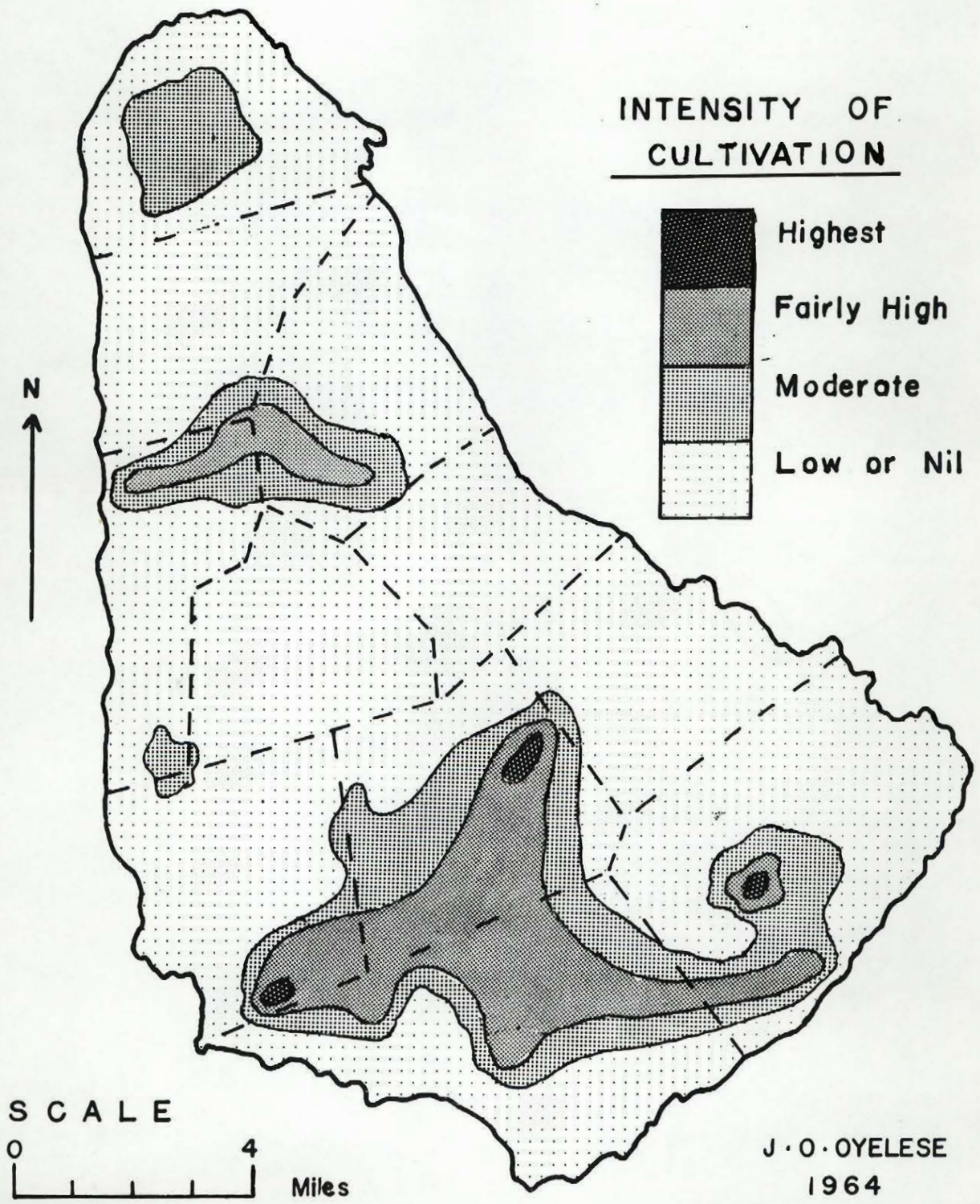

Figure 20

Christ Church. The northern part of the island covering almost the whole of St. Lucy and a narrow belt extending through the centre towards the west coast have moderate intensity of cultivation. The rest of the island has little or no cultivation in very poor areas.

The general distribution of yam cultivation is rather difficult to explain since most of the areas of cultivation fall within the low rainfall areas. Some of the peasants interviewed in the areas indicated that the crop's failure or success depends on the amount and periodicity of rainfall. However, they continue to plant yam because of its nice taste which is loved, especially by children. The low intensity of yam cultivation in the central, wetter areas is an anomaly which could probably only be explained by their greater concentration on sugar cane cultivation. Farmers in these areas probably avoid yam planting because of the great demand it makes on the soil nutrient and the subsequent reduction in sugar cane yield that follows its cultivation.

The areas where sweet potato is dominantly cultivated are very limited on the island,yet this limitation need not suggest that it is not a popular food crop. It is cultivated with varying intensities all over the island as Fig. 20 indicates. The areas of highest intensity lie in the southern part of the island, almost coinciding with the highest intensity area of yam, but becoming more intense towards the eastern section.

A portion of the central area lying across part of the parishes of St. James, St. Peter and St. Andrew show fairly high intensity; parts of St. Lucy moderate intensity; and the rest of the island, little or no cultivation.

The low intensity of sweet potato cultivation in the parishes of St. James, St. Thomas, St. Joseph, St. John, St. Peter and part of St. Andrew is attributed by farmers to the destructive activities of monkeys which are found in large numbers in these areas. These monkeys cause much damage to the crop before it is ready for harvesting and this discourages the farmers. The low intensity or lack of cultivation in the parishes of St. Michael and coastal parts of Christ Church is probably due to the intensive vegetable gardening practised there. The difficulty in storing sweet potato is another reason why some farmers do not plant much of it. The crop has to be sold within a very short time after harvest or else it will rot. The farmers therefore naturally reduce the acreage under cultivation.

The areas of high intensity fall within the rather dry areas of the island. It is probable that the tolerant nature of sweet potato, as far as water requirement is concerned, adds to its popularity in these areas.

Although the cultivation of corn is widespread on the island, there are large areas where this crop predominates. It is a rival of yam in

BARBADOS

DISTRIBUTION OF ACREAGE IN CORN 1962 – 63

(BASED ON THE DEVIATION OF THE SAMPLE MEAN FROM THE GRAND MEAN)

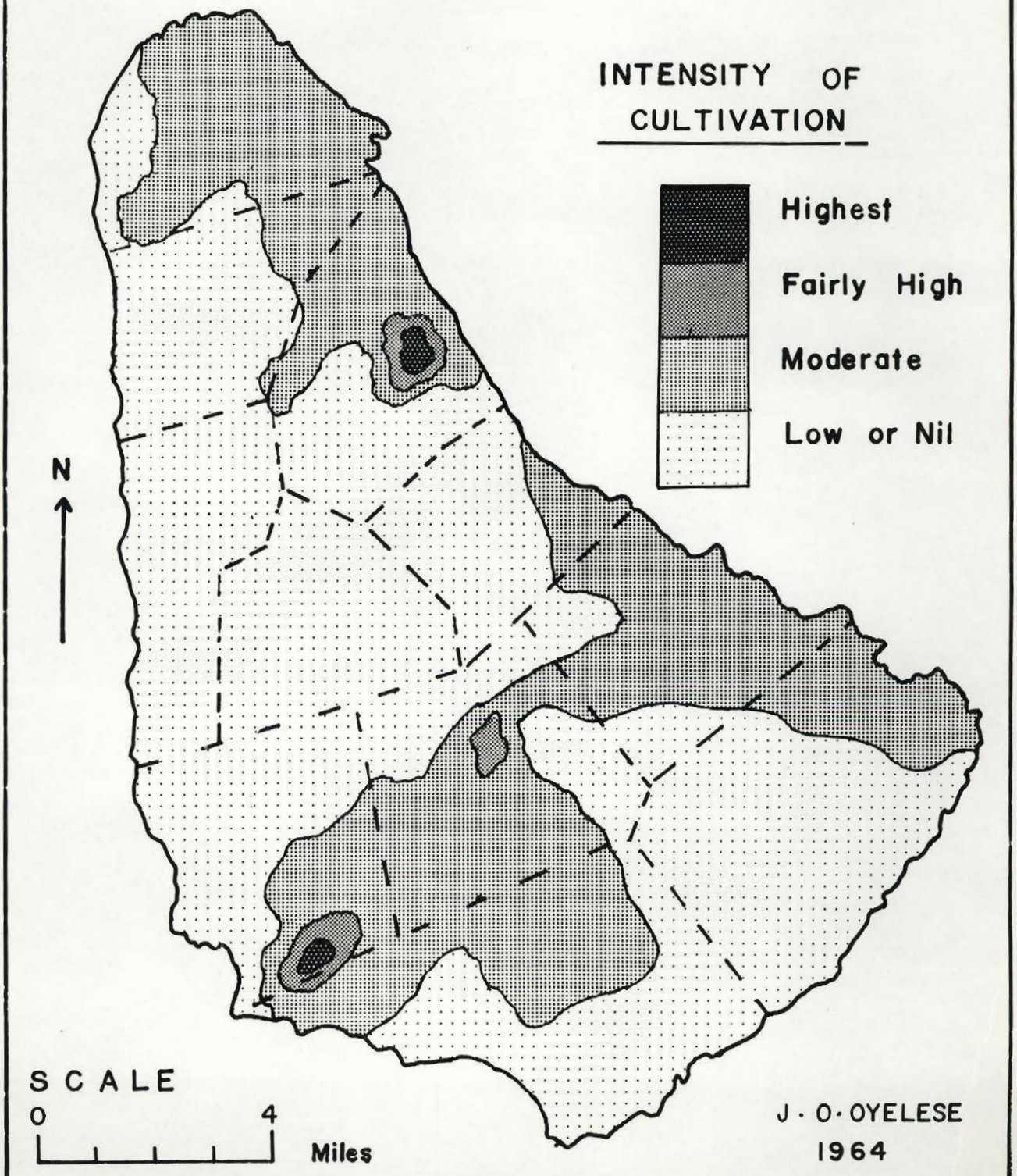

Figure 21

BARBADOS

DISTRIBUTION OF ACREAGE IN CASSAVA 1962 – 63

(BASED ON THE DEVIATION OF THE SAMPLE MEAN FROM THE GRAND MEAN)

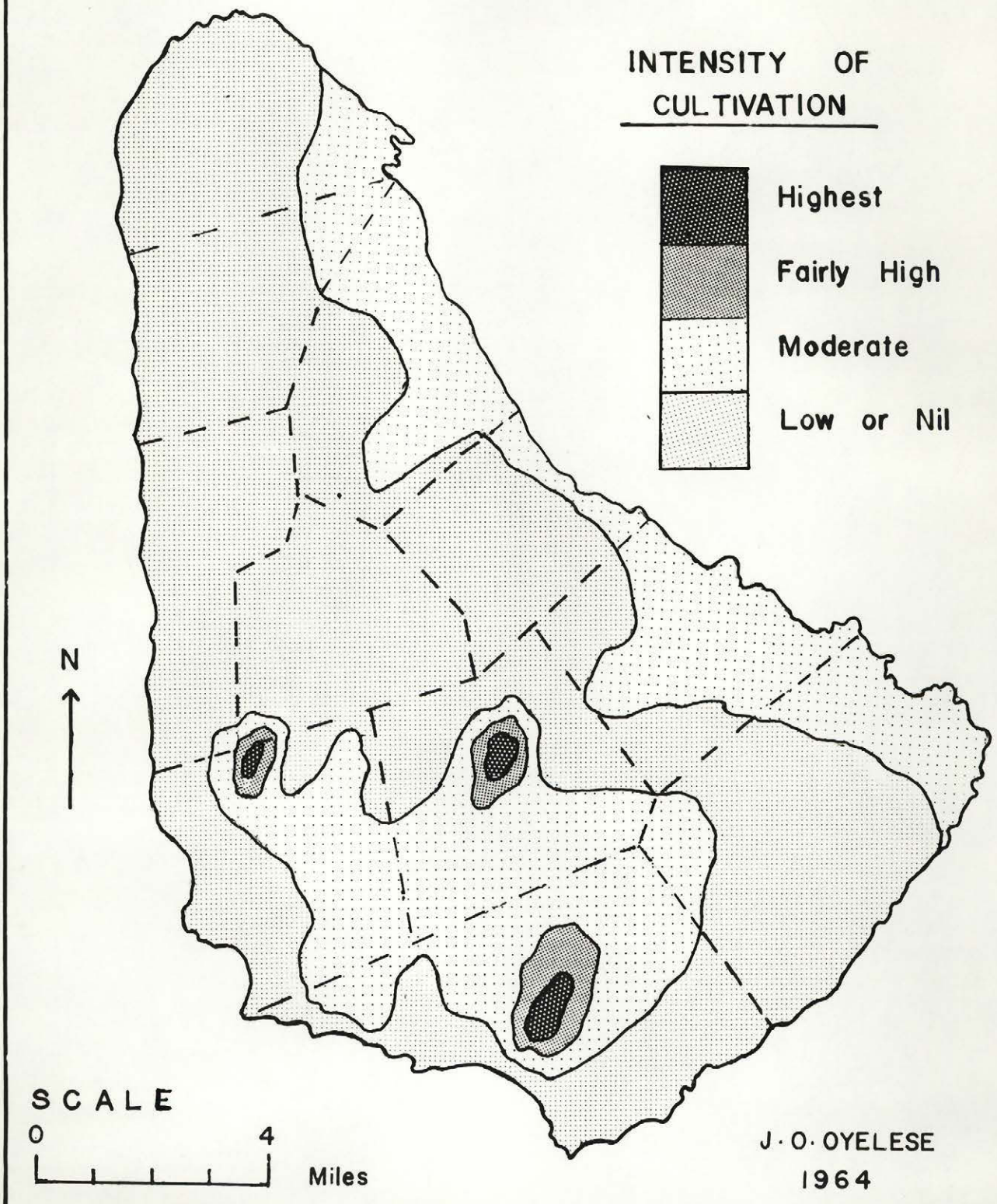

Figure 22

St. Lucy, it dominates the southeastern parts of St. Andrew and St. Michael, the central part of St. George, and nearly the whole of St. Lucy. In spite of the popularity of corn cultivation all over the island the distribution shows some marked concentration (Fig. 21). The areas of highest intensity are found in the parishes of St. Andrew and St. Michael. These concentrations are probably explained by their proximity to areas of dense population.

The areas of least intensity coincides with the central wetter parts of the island as well as part of the eastern areas. This distribution cannot be justified by the environmental factors since these areas are well drained and therefore quite suitable for its cultivation. The greater concentration on sugar cane cultivation might be responsible. These areas are, however, not completely devoid of corn as the farmers plant it around their cane fields and their houses.

The cultivation of cassava is obviously not very popular on the island. There is no particular area where its cultivation predominates. The distribution map (Fig. 22) reveals that it is cultivated mostly in the south within the parishes of St. Michael, St. George, Christ Church and also along the eastern part of the island.

The cultivation of eddoe does not predominate in large parts of the island. Pockets of cultivation are found in the parishes of St. George,

BARBADOS

DISTRIBUTION OF ACREAGE IN EDDOE 1962 – 63

(BASED ON THE DEVIATION OF THE SAMPLE MEAN FROM THE GRAND MEAN)

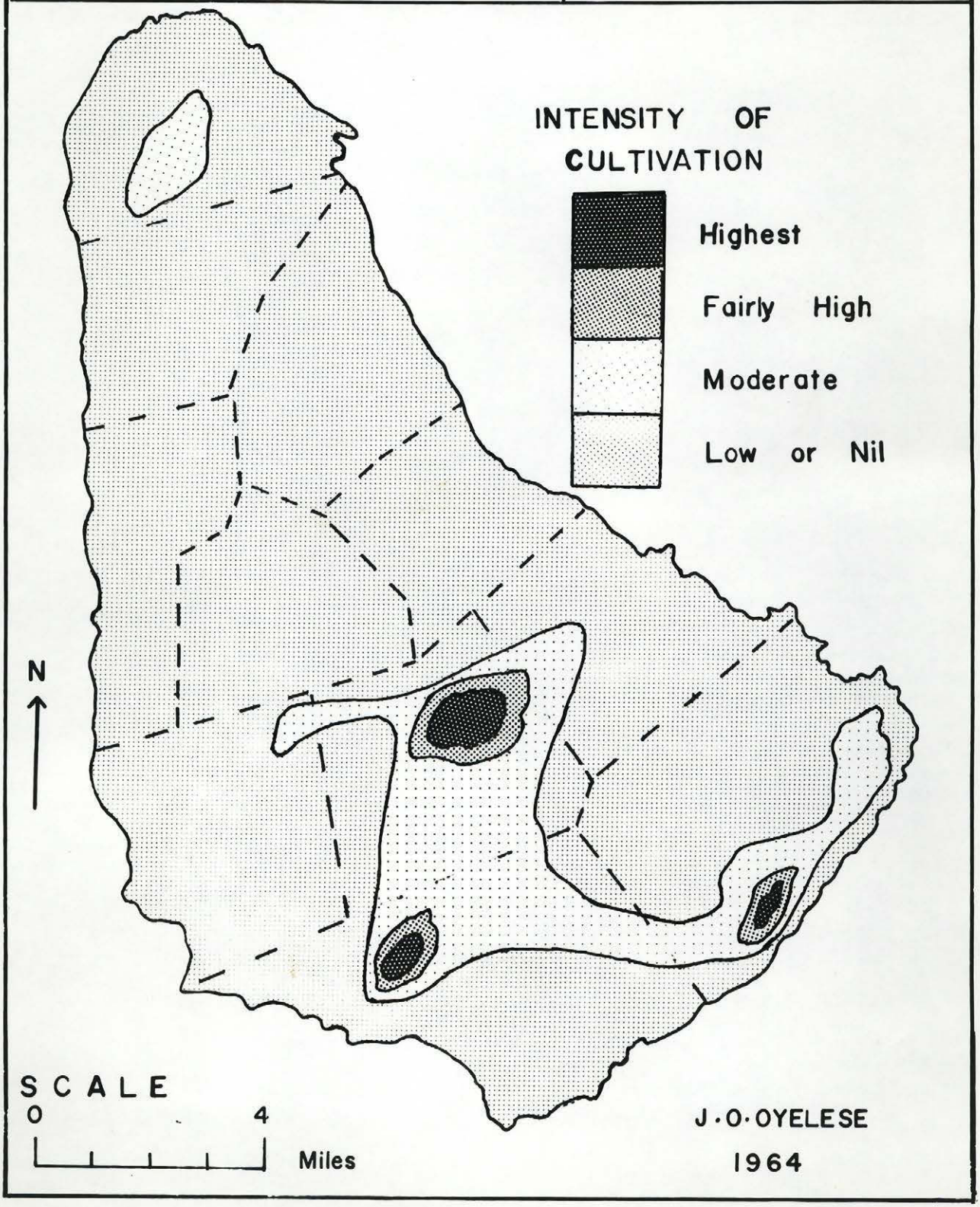

Figure 23

BARBADOS

DISTRIBUTION OF ACREAGE IN VEGETABLE & SEASONING 1962 — 63

(BASED ON THE DEVIATION OF THE SAMPLE MEAN FROM THE GRAND MEAN)

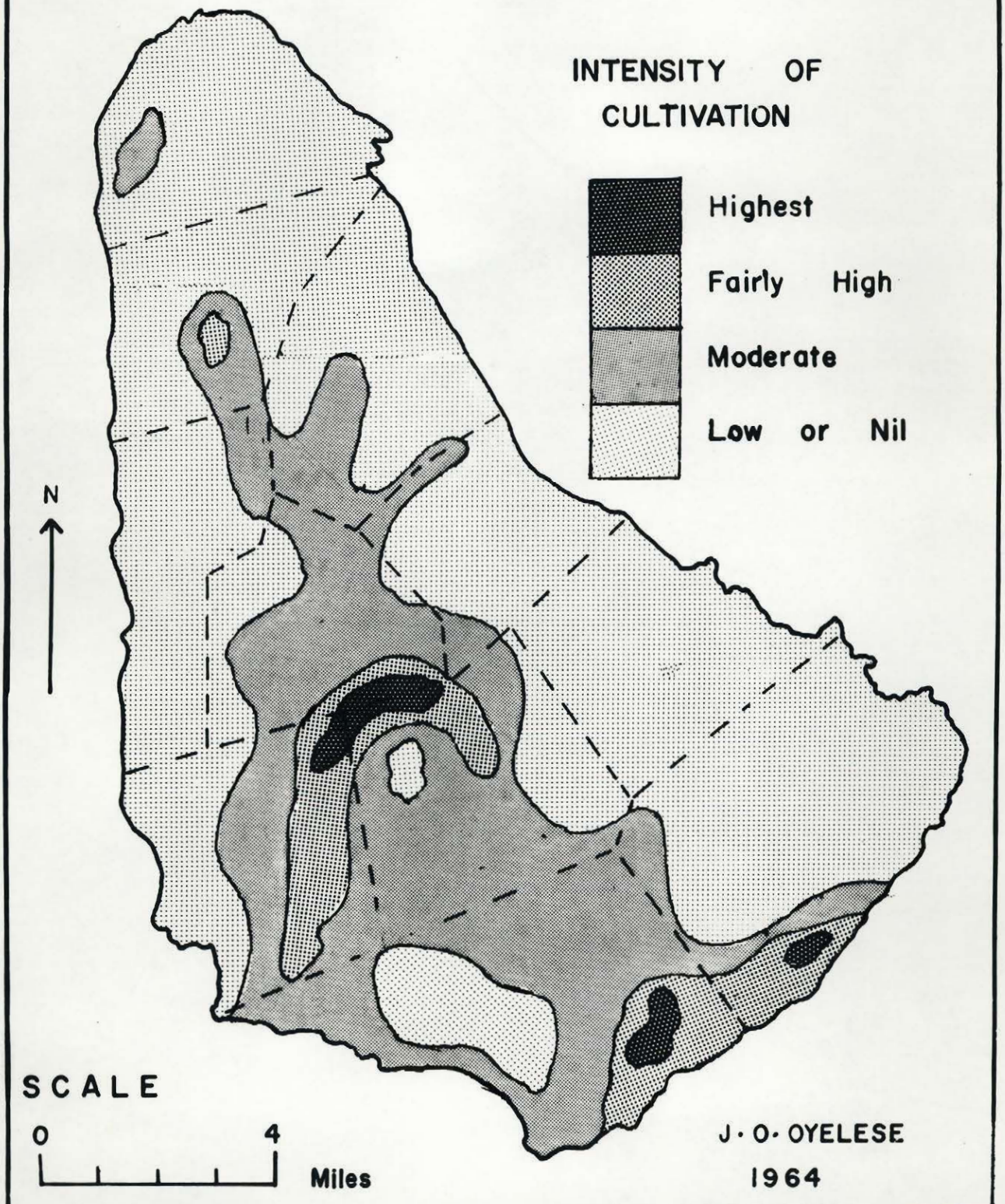

Figure 24

Christ Church and St. Andrew. The distribution map (Fig. 23) indicates that the areas with high intensity of cultivation are found in the southern part of the island. The narrow extension of high intensity area towards the coastal part of southern St. Philip is rather curious since the amount of rainfall here could hardly justify this. There is a similar area showing a moderate intensity in the relatively dry area of St. Lucy. The rest of the island, including the wetter central portion, has little or no cultivation of eddoe. The lack of cultivation is certainly not due to environmental factors.

Vegetables and seasonings predominate in a belt extending from northeast of St. Michael, through southeast St. Thomas, central part of St. Joseph and the southern part of St. Andrew parishes. There is another belt along the coast in the parishes of Christ Church and St. Lucy, where vegetable cultivation also predominates. The map (Fig. 24) showing the intensity of cultivation reveals that a much larger area of the island is used for the cultivation of vegetable than any other single food crop. In fact, the cultivation of vegetable is hardly absent anywhere on the island.

The areas with the high intensity of cultivation could be associated with both the wet areas and the dry areas where planting by irrigation is practised. The former areas are found northeast of Bridgetown and the latter areas where irrigation is necessary are found to the southeast along the coast. The intensity of cultivation could be associated with their

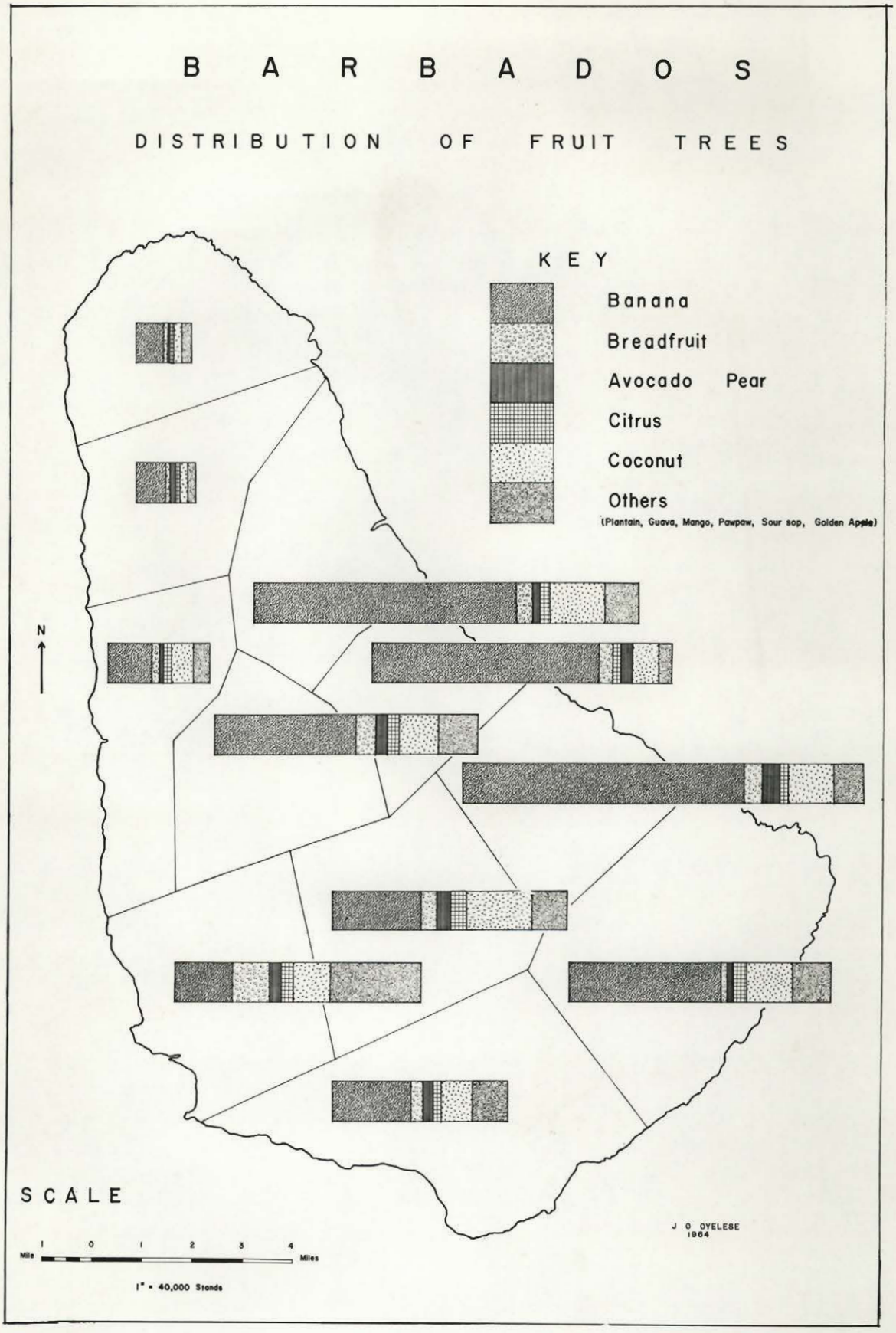
B A R B A D O S
DISTRIBUTION OF FRUIT TREES
KEY
Banana
Breadfruit
Avocado Pear
Citrus
Coconut
Others
(Plantain, Guava, Mango, Pawpaw, Sour sop, Golden Apple)
N
SCALE
1 0 1 2 3 4
Mile
Miles
1" = 40,000 Stands
J O OYELESE
1964

Figure 25

proximity to markets, the main ones being in Bridgetown, and the hotels situated along the southern coast of the island. Conversely, most of the areas of low or no cultivation could be attributed to lack of irrigation facilities or lack of a ready market.

The distribution of fruit trees on both the peasant holdings and the plantations can be treated under one heading because of the similarity in the nature of their distribution. The fruit trees, with the exception of the banana in some cases, are not found in pure stands anywhere on the island. Rather, they are found mixed and there is no indication of any definite pattern in their cultivation. It is difficult to estimate accurately the number of the different trees growing on the island especially from a sample survey such as was carried out. The map showing the distribution of these trees has been based, therefore, on the weighted averages of each of the fruit type within each parish. (Fig. 25)

The major factor adversely affecting the distribution of fruit trees on the island is their exposure to the effects of the strong winds. The areas most protected from the constant winds, viz. valley bottoms, gullies and leeward slopes are naturally the areas of highest density, provided all other conditions are satisfactory. The variations in the moisture distribution on the island do not seem to have much effect on distribution of these trees because of their deeper root system and also because many of them grow in the moister depressions.

The map showing the distribution of the fruit trees clearly indicates that the banana is the leading fruit tree of the island. It is planted almost everywhere but the intensity of its cultivation varies with the degree of exposure to the winds. The parish of St. John leads quite easily in the number of trees and it is followed by the parishes of St. Andrew, St. Philip, St. Thomas and St. Joseph in that order.

The main type of banana grown is of the Cavendish species. The Lacatan and the Dwarf Governor are the two most cultivated members of the species. The Governor is more suited to the shallow and wind-exposed soils of the island. All the varieties produce better, however, where they are well protected from the wind.

The distribution of plantains reveals that the crop is not very popular on the island. It grows much taller than the banana and this makes it more vulnerable to the effects of the winds. It needs, therefore, greater protection than banana. The parish of St. Michael leads in the number of trees, but these are planted mostly near dwelling houses or in protected gardens. The parishes of St. John, St. George and St. James also have considerable number of trees. The parish of St. Joseph records the least number of plantain trees.

The breadfruit and the coconut are planted in large numbers all over the island. They are very well represented in all the parishes although the number of coconut trees always exceeds that of the breadfruit.

The parishes of St. George and St. Andrew easily lead in the number of coconuts found on the island and the parishes of St. Michael and St. Thomas lead in the number of breadfruit.

The lesser fruits of the island are: citrus, mango, avocado pear, pawpaw, soursop, golden apple, and guava. All these fruit trees are found in considerable numbers in all the parishes but their distribution, like all the other fruit trees, are without any definite pattern. Many of them, like the mango, the pawpaw, and the guava trees, receive little or no attention and they are often found growing wild.

FOOD CROPS DISTRIBUTION ON PLANTATIONS

The cultivation of food crops in Barbados originally started on the plantations. As it has been pointed out in an earlier chapter, the sugar cane economy reduced the area devoted to food crop cultivation and it subsequently led to their complete neglect. The plantations, though, had been made to plant food crops by legislations at periods of scarcity or emergency, and the Local Food Production (Defence) Control Order, 1942, (Appendix III), which came into force during the Second World War, was the last of such measures. This Order has now become a permanent feature of the planting programme of the plantations and it is issued annually.

The food crops listed for planting under the Order are: yam, sweet potato, corn, eddoe, pulses, tomato and other vegetables. All the

plantations in the Coralline Limestone area are expected to plant 12% of their land in the food crops specified, and the plantations in the Scotland District 7% of theirs. Plantations in the Coralline Limestone area are expected to plant "Catch crops" of yam, sweet potato, and some corn and vegetables, and "Long crop" of sweet potato. The plantations in the Scotland District are requested to plant only the "Long crop" of sweet potato. The "Catch crops" are planted on the "Preparation land", i.e. the land on which sugar cane will be planted the following November, and the "Long crop" is planted on the "Thrown out land", i.e. the land left fallow until the following year's sugar cane planting period.

The purpose of the Production Order is to make sure that the plantations devote part of their lands to the cultivation of food crops, but the suitability of the environmental factors to the cultivation of these crops was not taken into consideration. The writer made an attempt to collect information from the plantations on the acreages devoted to each crop as well as their yield per acre during the 1962-63 crop season in order to assess and define the environmental suitability for the production of each crop on the island. Questionnaires were sent to all the plantations on the island but the response was rather poor. About twenty-six of the plantations from all the parishes except St. Joseph completed the questionnaire and from them a table showing the yields of yam and sweet potato at a few of these plantations has been compiled. (Table 3) The plantations have been arranged according to the rainfall regime on the island.

Table 3

Yield of Yam and Sweet Potato on Plantations
1962-63 Crop Season

Plantations & Parishes	Rainfall Area	Yield per Acre (lb.)	
		Yam	Sweet Potato
Coverley (Christ Church)	Less than 60"	865	1,142
River (St. Philip)	"	1,252	2,876
Bromefield (St. Lucy)	"	2,388	8,400
Alleynedale (St. Peter)	"	1,120	7,253
Halton (St. Philip)	60" - 65"	4,364	4,545
Carrington (St. Philip)	"	6,667	1,357
Rowans (St. George)	"	10,320	5,364
Norwood (St. James)	"	10,452	6,046
Welchtown (St. Peter)	"	7,478	782
Pool (St. John)	"	7,347	18,800
Lears (St. Michael)	"	9,032	9,491
Kendal (St. John)	"	6,956	14,040
Cottage (St. George)	"	6,667	5,937
Mt. Wilton (St. Thomas)	65" - 70"	10,394	10,269
Mt. Pleasant (St. Philip)	"	12,000	6,000
Applewhaites (St. Thomas)	"	8,710	9,186
Lion Castle (St. Thomas)	Over 70"	16,552	8,916
Walker Spring (St. Thomas)	"	24,388	6,912

The yield figures in these plantations are well correlated with the amount of rainfall, especially in the case of yam. It can be observed that even within these rainfall regimes, however, there are some little variations. These variations could probably be accounted for by the nature of the soils, the nature of the terrain, and the use of manure. The sweet potato yield on the other hand, shows no clear trend and the variations could be due to purely local factors, such as the destructive activities of the monkeys, rather than to the factors of rainfall and soils.

The production cost on these plantations also reveals the inherent weakness of the cultivation distribution based on the Production Order. Some of the planting records obtained from plantations reveal that it would cost about $258.00 to cultivate an acre of yam. The market "control" price of yam in Barbados is 5¢ per lb. It is obvious from this consideration that a farmer must have a yield of about 6,000 lbs. per acre of yam before he could make any substantial gain. If the figures in the table (Table 3) are examined on the basis of this calculation, then the plantations within the parishes of Christ Church, most of St. Philip and St. Lucy and part of St. Peter are not likely to produce yam economically.

The Order has been slightly modified for the 1963-64 crop season and the planters have been allowed to plant either yam, sweet potato or any of the crops allowed by the regulations on the preparation land. The only compulsion is that the whole of the 12% area must be planted in one

or more of these food crops. Probably if this improvement is carried further to specify the type of crops to be planted in the different areas according to the environmental suitability of the crops, the production figures would rise and the cherished goal of self-sufficiency in food requirements may be achieved up to a degree.

The production of food crops on the peasant holdings according to the distribution maps, is concentrated in the southern part of the island. This gives the impression that probably the peasants there concentrate more on food crop production than sugar cane. The assumption could be further strengthened by the fact that the southern part is more deficient in moisture, and this probably would tend to reduce sugar cane yield in some localities. Consequently the peasants probably find it fairly profitable to plant those food crops which would find a ready market. This assumption is perhaps more true in the case of vegetable cultivation. The food crop cultivation in most parts of St. George Valley, however, could not be so simply explained as it is equally suitable for sugar cane production. The paucity of food crops production in most of the central parts of the island is probably due to the greater emphasis placed on the sugar cane cultivation rather than any limitations imposed upon it by the environment.

CHAPTER V

SOME ASPECTS OF FOOD CROP CULTIVATION AND MANURIAL PRACTICES ON THE ISLAND

THE SYSTEMS OF CULTIVATION

The systems of cultivation in Barbados have been very much influenced by the sugar cane culture long established on the island. The cane-hole method of planting is seen both on the plantations and on the peasant holdings. These cane-holes are usually spaced 5' x 5' or 5-1/2' x 5-1/2' and the food crops are usually planted on the banks of the cane-holes. The making of ridges is now becoming popular with some of the plantations, and as a plantation owner explained, this system is much cheaper than the digging of cane-holes. The systems of cultivation is uniform on the plantations unlike the peasant holdings where about four different systems can be recognized.

The plantations have much larger areas to cultivate and they concentrate mainly on the cultivation of sugar cane. The cultivation of food crops starts with the end of the cane harvest which is April or May in the case of late harvest. The land which is not intended for a ratoon crop is then ploughed and made ready for the planting of the "Catch crops". This land could either be brought back under cane the following November

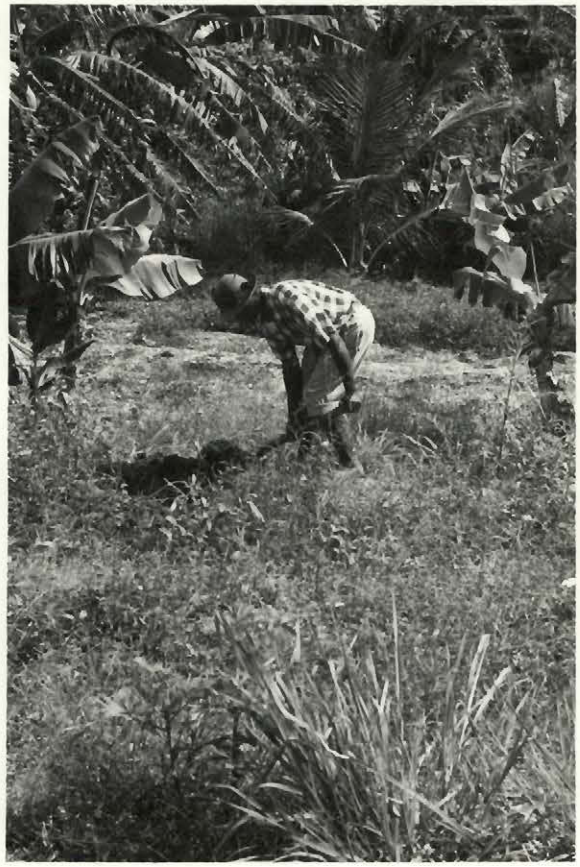

Plate III

A farmer turning the soil with the aid of a fork. The fork is one of the implements used by most of the peasants in breaking the soil before planting.

Plate IV

Baskets of Lisbon yams at an agricultural show. Lisbon is the main type of yam planted in Barbados. Those in the photograph reveal the average size to which this species of yam normally grows.

or it may be allowed to fallow for a year. Such fallow land, usually referred to as "thrown out land", is planted in the long crop, potato, in October or November and in yams in May of the following year. It is then brought back under cane, usually inter-planted with yam, in November.

There are about four systems of cultivation recognizable on peasant holdings. These systems have been described by a few writers as: (i) peasant sugar cane growing which is the most predominant system; (ii) mixed cultivation or rainy season annual crops system; (iii) intensive cultivation of vegetables with or without irrigation; (iv) a combination of the systems.

The predominant system of cultivation is that dependent mainly on sugar cane growing. The bulk of the area of the farm would be in sugar cane and the remaining area may probably be in mixed food crops. There is also a variation of this practice and that is the alternation between food crops cultivation and sugar cane cultivation. The land is put under food crops for a season and then it is brought back into cane after the harvest of the food crops. Over 79% of the peasant holdings on the island is under this system.

The mixed cultivation or rainy season annual system is prevalent in the drier areas of the island, such as parts of St. Philip, St. Peter, and St. Lucy. It is also practised in isolated cases all over the island. This

group of peasants represents the progressive ones trying to get away from the sugar cane culture. They plant both annual crops like peanuts, tobacco, and cotton, and food crops such as yams, corn, sweet potato, eddoe, cassava and vegetables.

The third group consists of those who are specialized in vegetable growing either with or without irrigation. The number of peasants making their living out of this system has started to increase steadily within the last few years and this is probably due to the financial support given by the government towards the establishment of overhead irrigation and the sinking of wells on the peasant holdings. The Agriculture Department has hand-picked some peasants in the parishes of St. Michael, Christ Church, St. Lucy and St. George to demonstrate to the others how profitable vegetable gardening can be.

Some peasants practise a combination of two or more of the first three systems of cultivation. The writer visited a farm on Rendezvous Road in the parish of Christ Church early in May and found it planted in vegetables (mainly carrots, beans, tomatoes, and cucumbers) and some cane. The same farm was visited in August, and it was planted in corn, yam, some carrots, cucumber and some cane. This type of rotation is found also in other parts of the island.

Contour Farming:- A system of farming which is yet to become popular

on the island is contour farming which system has been advocated in Barbados for some time now. Halcrow, M.[1] in a series of talks given to peasant farmers in 1947 and 1948 mentioned the methods of laying out the bed, the rotational practices advisable, methods of planting and manuring. In his conclusion, he pointed out that contour farming, preferably in conjunction with livestock if carried out systematically as outlined, had every prospect of providing a satisfactory solution to the problem of maintaining and improving the fertility of peasant holdings as well as estates in the drier areas, and possibly throughout the greater part of the island.

The fairly steep gradients in some parts of the island, more especially in the high rainfall areas, also make the use of contour farming advisable since this method checks soil erosion and provides a more effective catchment for rain in addition to allowing easy movement both during the cleaning of the farms and the harvesting of crops. The cane trash and plant wastes are buried in the furrows before making the beds and these improve the fertility and tilth of the soil. The reconstruction of the beds, usually every four years, reduces the amount of labour put into cane-hole digging.

The method is not yet practised widely on the island, although

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1. Halcrow, M. - "Contour Farming" - Department of Economics and Agriculture, Barbados - Pamphlet No. 15 (1947)
Halcrow, M. - "Contour Cultivation in Barbados" - Department of Economics and Agriculture, Barbados, Pamphlet No. 16 (1948)

there are a few estates and a few peasants who use it, and in this they are usually assisted by the Extension Officers of the Agriculture Department.

Farm Equipment:- The use of the tractor and the plough for cultivation is becoming very popular with the peasants of Barbados, especially those who possess lands over one acre in size. The survey carried out revealed that out of the farms sampled about 46% of the farmers depend on the ploughs and tractors hired from plantations and the government agriculture stations for the preparation of their lands for planting. Further investigation showed that many more farmers would use tractors and ploughs if they could get them to hire but there seems to be a shortage of these on the island. The remaining 54% of the peasant farmers interviewed depend on their fork and cutlasses for the preparation of their lands.

Use of Manure and Fertilizers:- The use of manure is widespread on the island. The peasant farmers know the value of pen-manure to crops and their problem is probably how to get enough of this. About 89% of the farmers interviewed during the sample survey reported that they use pen-manure for their crops. Artificial fertilizers are not as much used probably because the peasants cannot afford them. The survey revealed that about 65% of the farmers use at least some amount of artificial fertilizers and some 51% of them use both pen-manure and artificial fertilizers. Nonetheless it is true that most of the peasant farmers still have a lot to learn about manuring of crops.

PLANTING PROGRAMME & MANURIAL PRACTICES

The planting of food crops starts after the cane harvest both on the plantations and the peasant holdings. The period of actual planting depends on the time the rains come and for most parts of the island they do not occur in sufficient amounts until the month of June. In the dry areas of the south this may be delayed until July, so that planting time for each crop throughout the island may vary considerably.

Yam:- The planting of yam, usually carried out in May just after the cane harvest is completed, is made possible by its low water requirement during the early part of its growth. The crop is usually harvested in February of the following year. The two types of yam most common in Barbados are the Coconut Lisbon and the Barbados Lisbon, but others like Horn, Oriental and Crop (Hunt) are also sometimes planted. The plantations plant yams either on the preparation land or on the thrown out land. When the latter is used, planting is done the year following cane harvest. In this way the soils are exposed to severe desication during the intervening dry season. In April and May the earth formed by the disintegration of the soil clods is raked into the old cane-hole from the surrounding banks. The bed thus formed has an excellent structure and the yam is planted in it. Such planting is done in June.

The yam seeds, usually small tubers or cut tubers each of which weighs about 4 ozs., are planted in the cane-hole, on ridges, and in some

cases on mounds. Pen-manure is used on the holdings but the manure is put round the yam hole rather than inside it. This practice was copied from the plantations. It is believed that if the pen-manure is put in the yam hole, it might not decompose fast enough and the yam planted afterwards would only produce foliage rather than tubers. Fertilizers are not used directly on yam, but the effect of those used on the cane crops is still beneficial to it.

The staking of yams is absent in Barbados due to the scarcity of materials that can be used as stakes. The farmers have not thought of an alternative method of keeping the yam vines off the ground, although they realize that this would improve the crop yield. The cultivation of Guinea corn should be given some consideration as a possible solution to the problem of stakes especially since this plant does well on Barbados' soils, and the stalks are strong enough to support yam vines. Moreover, the grains could be used for food or as fodder for feeding livestock. The interplanting of corn with yam is not as effective because corn has a weaker stalk than Guinea corn.

The Department of Agriculture had made efforts in the past to improve yam cultivation on the island. Several experiments were carried out and the reports were given by Blackburn, F.H.B.[1]. The first manurial

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1. Blackburn, F.H.B. - "Manurial Trials with Food Crops" - Department of Science & Agriculture, Barbados, Bulletin No. 4, May, 1945.

experiment carried out at the Codrington Experimental Station in an area of low rainfall and black soil was to determine the effect of the application of nitrogen and potash on the yield of yams and also to ascertain the value of mulching yams with sour grass. Unfortunately, the rainfall for the critical months of June, July and February was unusually low. Mulching, however, was given a fair trial under these conditions. The results show that under the experimental conditions, neither mulching nor the fertilizers applied resulted in an increase in production. Another experiment with the application of super-phosphate also resulted in no increase in yield. It was concluded that probably, in many local soil types on the island, the tilth of the soil may be the principal factor limiting yield in root crop production.

Later experiments with pen-manure, aided by a very wet season, resulted in good yields on peasant farms. This is probably why pen-manure is so much used in yam cultivation on the island.

Sweet Potatoes:- Sweet potato is planted twice a year. The first crop is planted in June and the second crop in October or November. The first crop is planted on the preparation land of the plantations and the second crop is planted on the thrown out land. The crop planted in June is harvested in October or November and that planted in October or November is harvested in January or February. The sweet potato is usually propagated from slips about 9 to 12 ins. long and planted to a depth of 6". These

slips are manually planted one foot apart on banks that are four feet apart.

There are many types of sweet potatoes planted on the island and several experiments have been carried out to determine their suitability. The Production Order invariably specifies the types of sweet potato that must be grown on the plantations; for example, during the 1963-64 crop season, the plantations were asked to plant one or more of the following varieties: B.44, Black Rock, White Gilkes, V.52, Caroline Lea, and B.5. The peasants usually obtain their slips for planting from the plantations and, as a result, they plant the same types of sweet potato as do the plantations.

Experiments aimed at finding out the most suitable variety of sweet potato that could be produced economically on the island, have been carried out by the Department of Agriculture. The suitability of any variety depends on (i) its yielding capacity, (ii) its suitability for long period storage, (iii) the colour of its skin, (iv) its flesh colour after cooking, and (v) its taste. The experiment carried out in many stations on the island[1] revealed that the following types were most suitable for large scale production: B.5, B.6, B.44, and V.52. These varieties are still widely grown.

The farmers of the island do not manure the plots on which sweet

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1. Sweet Potato Variety Trials - Agriculture Journal, Department of Science & Agriculture, Barbados, Vol. 2, No. 3, July 1933; Vol. 3, No. 4, October 1934; Vol. 4, Nos. 1-4, 1935.

potato is planted. The previous experiments have shown, however, that the crop would benefit from the application of pen-manure. The planting of sweet potato on ridges has also been proved to be more productive than flatland planting associated with the cane-hole system.

Corn:- The planting of corn is traditional on the island as was revealed in an earlier chapter. Corn is usually planted with the arrival of the rains in June or July depending on the part of the island involved, and harvested in October or November. The seeds, about 4 or 5 in each hole, are sown on the banks of the cane-holes. In this way the corn is spaced in groups of 4 or 5 plants 2-1/2' x 5' apart. The main type of corn planted on the island is the Flint.

As in the case of the other short-term food crops, the peasant farmers as a rule apply no manure or fertilizers to this crop, but some of the plantations apply nitrogen in the form of sulphate of ammonia to the land prior to the planting of the corn.

The experiments performed by Robinson, J.B.D. [1] into the effect of manuring on the yield of corn shows that an application of about 2cwt of sulphate of ammonia per acre would cause a large and economic increase in the production of the grain.

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1. Robinson, J.B.D. - "Manurial Trials with Corn" - Department of Science & Agriculture, Barbados, December 1950 - Bulletin No. 16 (New Series).

Cassava:- This crop is not widely planted on the island although it could be grown easily in many localities. The Production Order has helped to increase the acreage under this crop quite considerably. The regulation specifies that it should be planted in September on the plantations, but the crop could be planted at any time during the rainy season. The most important consideration is to get the plant established before the dry season sets in. It takes from 6 to 24 months for the crop to mature, depending on the variety, the soil and the moisture conditions. It is propagated from mature stem cuttings 6 to 18 ins. long which are planted 3 to 6 feet apart in rows which are spaced about 4 to 6 feet apart. The only two varieties cultivated are the sweet cassava and bitter or poison cassava, the former maturing much earlier than the latter.

An experiment carried out to determine whether cassava could benefit from the application of pen-manure or fertilizers revealed that it does not respond economically to either.

Eddoe:- The eddoe is usually inter-cropped with other crops such as okra, corn and cassava, and it is replanted once every year. It is sometimes also inter-planted with the sugar cane. Some plantations grow pure stands of eddoe.

When eddoe is planted in pure stands a spacing of 3 to 4 feet between the rows and 15 to 18 ins. within the rows, or a square spacing of 2 to 2-1/2 feet, is adopted. When grown with sugar cane it is planted on the banks of the cane-holes. The crop is usually planted in July on the plantations, but

Plate V

The different types of banana-planting material. In the foreground is the "maiden"; left of the centre is the "bull-head", and behind it is the "sword". The implement held by the man crouching is a "cutlass" which is used along with the "fork" by the peasants for cultivation.

Plate VI

The "Governor", a type of banana of the Cavendishii sp. in fruit. It is the most cultivated banana on the island in the fairly exposed areas because of its height advantage. The effect of the winds can be seen in its torn leaves. Such leaf damage may reduce the quality of the fruit quite considerably. Note also the mulched vegetable bed. Mulching helps to preserve the moisture in the soil during the dry periods.

in May or June on the peasant holdings. It is harvested 5 or 6 months after planting.

Experiments have shown that eddoe responds very favourably to nitrogen, potash and pen-manure, but the peasants of the island do not apply any of these to their holdings before eddoe is planted, possibly because they cannot afford them.

The Fruit Trees:- There are many types of fruit trees in Barbados, but as McIntosh, A. E. S. and Hanschell, D. M. [1] have observed, the majority of them were propagated from poor seedlings. There have been some efforts lately, however, to replace these poor trees with good quality trees. The Agriculture Department has established nurseries in some of the Agriculture Stations from where interested farmers could buy seedlings for planting.

Banana:- Banana has been suggested as an alternative crop to sugar cane on the island. This, as a result, brought the cultivation of the plant into some prominence. There is a fairly large number of banana trees on the island and these are made up mainly of the Cavendish species.

Banana is usually planted from suckers of which there are four types (i) the maiden, (ii) sword and peeper, (iii) bull-head, and (iv) water sucker. The maiden is a banana stool which may be of any age above 3 to 4 months,

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1. McIntosh, A. E. S. and Hanschell, D. M. - "Recent Experiments with Minor Crops" - Department of Science and Agriculture - Agriculture Journal, Vol. 9, No. 1 (Jan. 1940.)

Plate VII

Banana trees interplanted with sugar cane. The sugar cane acts as a wind-break when it is full grown. In the photograph, the original sugar cane crop has been harvested and the "ratoon" crop is almost high enough to act as a wind-break all over again. This practice is becoming widespread on the island.

Plate VIII

Citrus experimental orchard at Haggatts Agricultural Station. The orchard is situated in a well-sheltered site, the type of which is common along some of the main gullies. The citrus plants are hybrids and are planted in holes filled with fertilizers. The agricultural officer in the photograph is standing in one of the new holes, the depth of which could be estimated at between 18" and 24".

but which has not yet "shot" a bunch. This is perhaps the most vigorous and best planting material if care is taken that the main eye or shoot is not damaged. The sword derives its name from the shape of the leaves which remain narrow and small. It is an excellent planting material with a large reserve of food stored at the base. The peeper is the very young sword. The stool remaining after the bunch has been harvested is called the bull-head. This could be cut into several pieces depending on the number of eyes on the bull-head. Such pieces should not be planted in very wet localities or at the peak of the rainy season because of the danger of rotting. In planting, the cut portion should never be placed upwards. The water-sucker is the worst of the planting materials and it is not advisable for propagation.

Bananas should be planted in well-drained, rich soil and must be protected from wind. The peasants and even the plantations do not adopt any system in the planting of banana. The ideal practice is to make holes approximately 18" x 18" x 18" at spacing of 6' x 8' or 8' x 8' or 8' x 10' or 10' x 10', depending on the nature of the site and soil fertility. These holes should be filled with pen-manure mixed with fertilizers and the soils removed from the hole during planting.

Plantain:- The fact that the cultivation of plantain is not as popular as that of banana on the island may be due to the greater protection the plant needs from strong winds. In addition, it requires a greater amount of rainfall,

about 80 to 100 ins. for good yield. The crop, planted during the rainy season from suckers, can benefit from the spacing used for the planting of banana.

Breadfruit:- This plant, found all over the island, is propagated by root suckers; it is doubtful, though, whether all the trees on the island were actually planted. The highest density of trees is found in sheltered and moist areas like the gullies. It takes about 3 to 4 years for the tree to fruit. There are two main types on the island, one bears fruit with white flesh and the other with yellow flesh. The latter is on the whole preferred. Some of the trees bear their fruit later than others so that the supply of breadfruit on the island is almost year-round.

Avocado Pear:- The avocado grows in all the parishes of the island. A survey of the bearing trees indicated that they vary not only in size, quality and abundance of fruits, but also in their season of fruit bearing. The normal fruiting season lasts from September to December. There are some trees, however, producing fruits consistently outside the season, some in January, others in February or even as late as May.

The best yield is obtained from deep moist soils in situations sheltered from strong winds. The improved variety is propagated by budding. The planting distance between trees is about 25 feet. The tree takes about 3 to 5 years to bear fruit.

The tree will respond favourably to heavy and regular applications of pen-manure and fertilizers.

Citrus:- The main citrus species cultivated on the island are: lime, grapefruit, sweet orange, sour orange and lemon. The lime is the most popular of all these, followed by the grapefruit. There are other lesser citrus species such as the mandarin, shaddock, pomelo and lemon which, of late, are becoming increasingly popular with the peasant.

The factors operating against the successful cultivation of citrus are wind exposure, shallow soils, and low rainfall. The areas most profitable for citrus cultivation on the island are therefore the sheltered valleys, gardens and gullies. Citrus should be planted in holes at least 24" wide and 18 to 24 ins. deep. The soil taken out of the hole should be mixed with pen-manure before it is replaced. Further soil may be added until a mound of about 6 ins. high is formed around the tree. The area around the young tree could also be mulched. The trees should be planted about 20 feet apart.

Coconut:- The coconut trees are found planted mostly around dwelling houses in Barbados but there are areas like the Scotland District and along certain parts of the coast where they are found in large stands.

The plant grows well on a free draining soil which is at least 4 feet deep to the water table. The nuts are planted and it has been suggested that

Plate IX

Grafted mango tree at Haggatts Agricultural Station. The man in the picture touches where the "stock" and the "scoin" were grafted. This type of mango tree is now being planted by the peasants to replace the inferior types presently growing on their holdings. A young avocado pear tree is growing in the background.

Plate X

Eddoes planted on ridges in one of the plantations. Ridging, which is a new trend in cultivation on the plantations, is gradually replacing the cane-hole. The eddoes are planted on what is known as "preparation land", i.e. land that would be put in sugar cane the following November.

this should be "hatched" before it is planted on the permanent site. The ideal planting distance is 25 feet for dwarf coconut, and 30 feet for the king coconut. Coconuts bear better when they are treated with potash and sulphate of ammonia which they require more than any other crop.

Mango:- The mango is widely distributed over the island but most of the trees are from poor seedlings. The Agriculture Department has some grafted species that could be propagated by the farmers and these are of two types - the dwarf species and the large species. The planting distance for the dwarf species is 20 feet and for the large species 30 feet.

Mango trees should be planted in free draining soils as they will not thrive in water-logged soils.

Pawpaw:- The pawpaw tree receives very little care from the farmers of the island. The tree is planted during the rainy season and it takes about 1 to 1-1/2 years to mature. The tree grows well in moist, sheltered conditions and should be spaced at 8 to 10 feet apart. They also respond very well to heavy dressings of manure.

Soursop:- The soursop is grown mostly around dwellings all over the island. It is a popular fruit tree and it takes 3 to 4 years to mature.

Golden apple:- The tree is grown around dwellings although it is also found in moist and sheltered situations away from the dwellings. Its

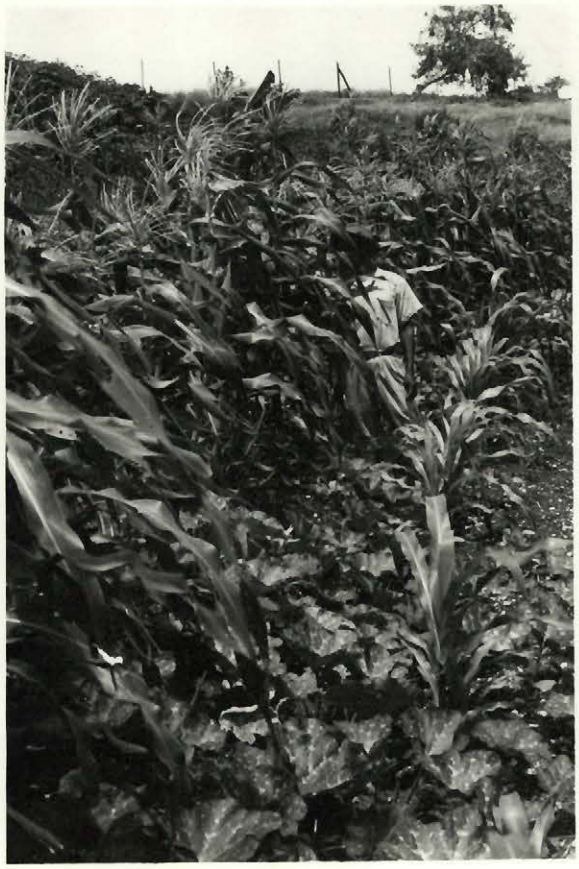

Plate XI

Corn intercropped with cucumber on peasant holding. This trend of cultivation practice is popular with the peasants as a result of the limited land at their disposal.

Plate XII

A vegetable plot with young sugar cane planted in the furrows between the beds. Vegetable cultivation is seasonal in most parts of the island and sugar cane is usually planted towards the end of the season to replace the vegetables. This farmer also planted corn on the plot next to the vegetables.

distribution is more restricted than some of the other fruit trees.

Guava:- The tree is not well cared for on the island. It is mostly used as fencing material and grows wild in many localities. It would grow practically anywhere, even on very thin soils. If grown in better situations, however, it would bear better fruit.

The tree is propagated from seeds and it will take 3 to 4 years to mature.

Vegetables and Seasonings:- The cultivation of vegetables and seasonings is carried out on small plots around dwelling houses and on well-laid out beds on the peasant holdings. Halcrow, & Cave[1] have distinguished the different planting periods of the commonly grown vegetables, but these periods can only be regarded as general since, given enough water, vegetables could be cultivated all the year round. This has been made possible in the localities where irrigation facilities have been provided.

In areas where there are no irrigation facilities, however, the cultivation is carried out mainly during the rainy season.

The use of fertilizers and manure, both pen-manure and compost is wide-spread in the cultivation of vegetables on the island. The fertilizer

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1. Halcrow, M. & Cave, J.M. - "Peasant Agriculture in Barbados" - Department of Science and Agriculture, Bulletin No. 11 (New Series) - Oct. 1947.

recommended by the Department of Agriculture is the V. G. M., which is made up of 2 parts of Sulphate of Ammonia, 2 parts of Superphosphates, and 1 part of Muriate of Potash. The recommended application is about two to three ounces per square yard applied before planting and raked over, and the same quantity could be applied a month later. The compost manure is excellent for vegetable cultivation and should be applied regularly.

The peasant farmers of Barbados have got a well-developed cultivation tradition which places them above most of their counterparts in other parts of the world. They know the values of manures and fertilizers to crops and they make use of them whenever they are available.

The use of the plough and tractor is becoming very popular and it is the lack of them in sufficient numbers that is the problem. The fork (the most common implement) is properly used and, on the whole, the land is well managed. The survey of farms carried out showed that about 90% of the farms are well forked, free of weeds and protected from erosion.

The farmers have also benefited from the manurial practices carried out by the Department of Agriculture over many years. The Agriculture Department also sells seeds and seedlings to the peasants and these are usually of very good quality. Regrettably many peasants are not taking full advantage of this opportunity, but those farmers engaged in the cultivation of vegetables buy almost all their requirements of seeds from the Department.

CHAPTER VI

THE FUTURE POSSIBILITIES OF FOOD CROP PRODUCTION IN BARBADOS

It has been shown in the previous chapters that a considerable amount of the food requirements of the island is produced locally. In spite of this, Barbados depends greatly on imported food both for the human population and for the livestock. It has often been suggested that production of food crops should be increased but the extent to which this could be done is limited by the extent of land used for sugar cane cultivation.

There is hardly any piece of cultivable land on the island which has not been utilized and this limits any expansion areally. The peasant farmers could probably be convinced to reduce the area in sugar cane and devote more land to food crop cultivation but this will only solve part of the problem. The plantations which have more land than the peasants could also be made to increase the land under food crops, but this could only be done if the planters are sure of an economic return.

The question of future possibilities of increased production of food crops in Barbados, therefore, depends on three main factors. These are: (i) a re-orientation of the cultivation distribution, (ii) the economic

aspects of food crop production, and (iii) the Land Tenure system.

(i) Re-orientation of Cultivation Distribution

There is a fairly wide scope for increase in production of some of the food crops now cultivated in Barbados, but in order to bring about this increase the basic requirements of these crops have to be well understood. The main factors of the environment essential to crop cultivation on the island are rainfall, both the amount and distribution, and the nature of the soils. Of lesser importance is the terrain but this does not constitute a great obstacle to cultivation except in areas of very steep declivities in the Scotland District.

The present distribution of food crop cultivation on the peasant holdings does not reflect suitability of their cultivation. This has been well shown by the comparison of the yam yield with the rainfall distribution on some plantations. The time has come when there must be definite planning so that each piece of agricultural land is put to its best use on the basis of its being more suited for the use of one or more food crops to the exclusion of all others. It is this consideration that has made the writer attempt a delimitation of areas most suitable for the cultivation of yam, sweet potato, corn, cassava, and eddoe on the island.

The criteria used in delimiting the areas most suitable for the cultivation of the crops are: (i) the annual and monthly rainfall distribution,

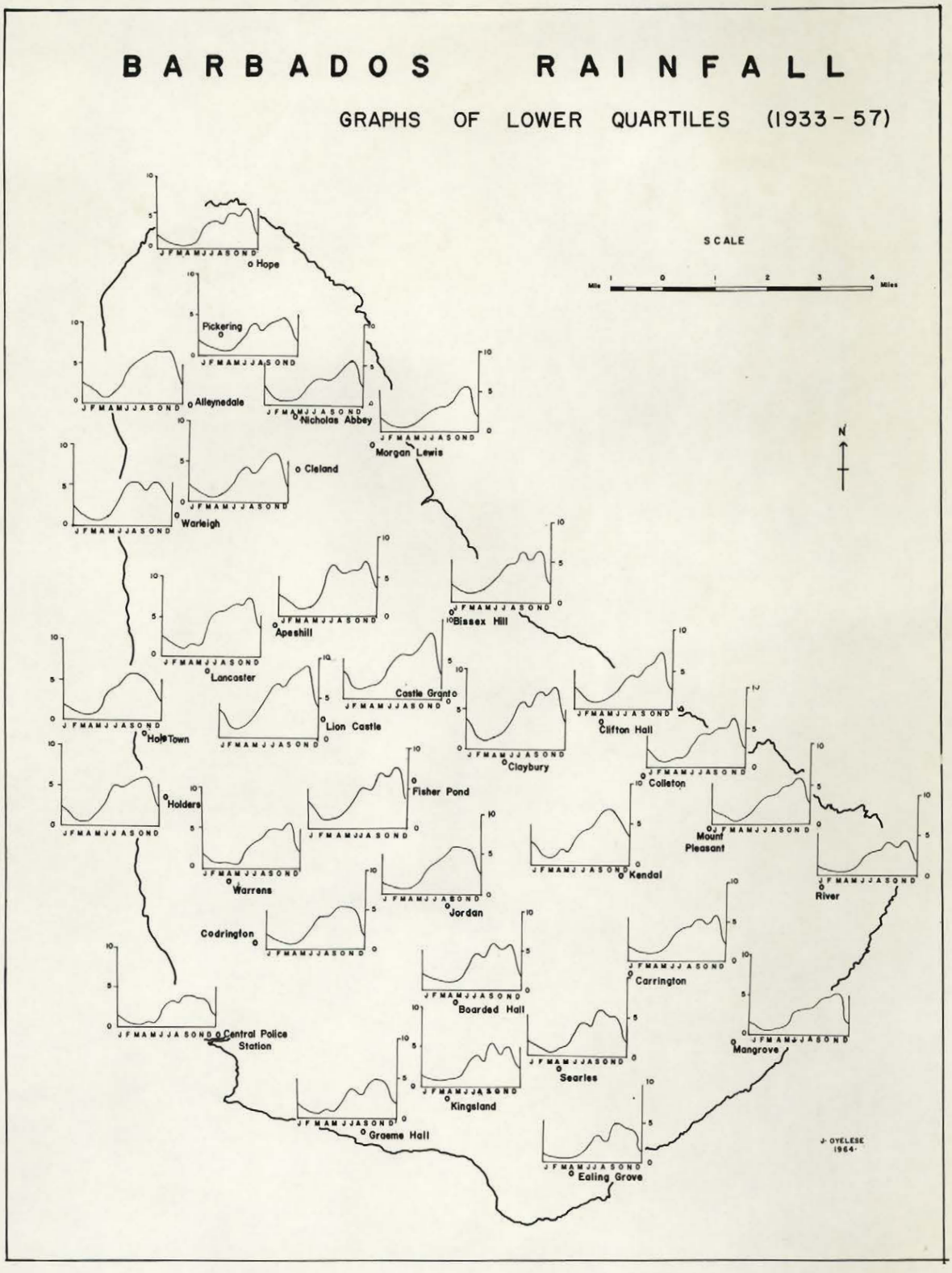
BARBADOS RAINFALL
GRAPHS OF LOWER QUARTILES (1933 - 57)
SCALE
Miles 1 0 1 2 3 4 Miles
N
J F M A M J J A S O N D
Hope
Pickering
Alleynedale
Nicholas Abbey
Morgan Lewis
Cleland
Warleigh
Apeshill
Bissex Hill
Lancaster
Castle Grant
Lion Castle
Clifton Hall
Claybury
Hole Town
Colleton
Holders
Fisher Pond
Mount Pleasant
Kendal
Warrens
River
Jordan
Codrington
Carrington
Boarded Hall
Central Police Station
Mangrove
Searles
Kingsland
Graeme Hall
Ealing Grove
J. OYELESE 1964

Figure 26

(ii) the nature of the soils, and (iii) the topography. The areas thus obtained, although hypothetical, could be regarded as the optimum areas of production if allowance is made for minor limiting factors in localized places.

As has been indicated, the cultivation of yam is very popular on the island. Its distribution (Fig. 19) shows that this crop is sometimes produced in areas where it cannot give economic yields. Yam is a crop that requires fairly heavy rainfall especially during the critical period of growth. It is true that yam could be cultivated under an annual rainfall of 45 ins., but it has been shown that for good economic returns an annual rainfall of 60 ins. is preferable. The critical periods of yam growth in Barbados are the months of June and July when the plant starts to establish itself. The average monthly rainfall for this period, necessary for vigorous growth, should not be less than 6 ins. If the distribution within the month is considered then it could be assumed that the lower quartile of rainfall distribution should not be less than 3.5 ins. for June and 4 ins. for July. (Fig. 26) The months of January and February should also have some rainfall to keep the mature yam crop from being spoilt by the heat of the sun. It has been suggested that a distribution with the lower quartile greater than 1.5 ins. might be sufficient. Yam also requires a well drained, rich, fertile clay or sandy loam. It would not do well on water-logged or very heavy and compact soils. The crop also prefers a fairly level or gently undulating topography.

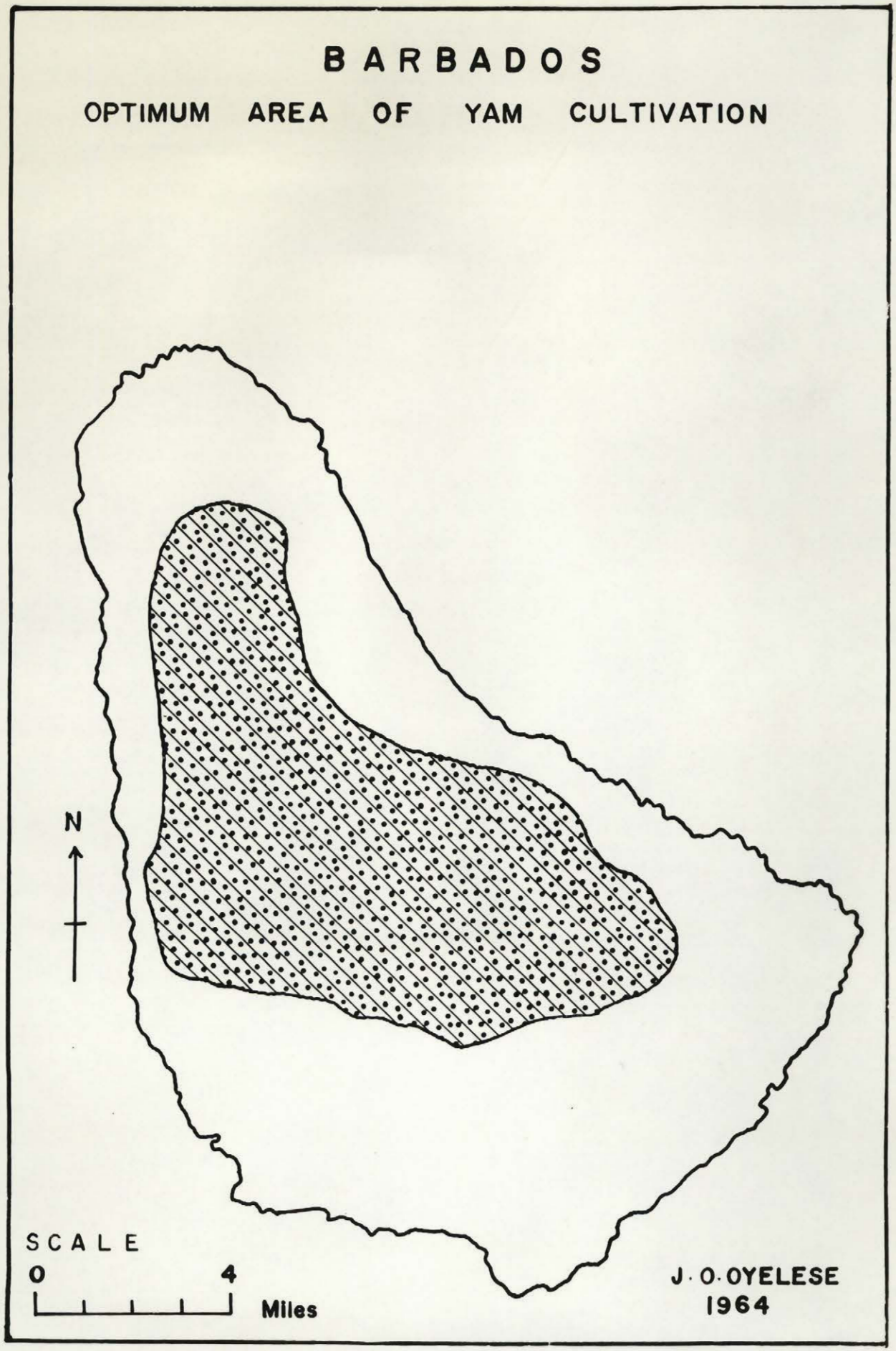
BARBADOS
OPTIMUM AREA OF YAM CULTIVATION
N
SCALE
0
4
Miles
J. O. OYELESE
1964

Figure 27

If these considerations are applied to the island, the area shown in Fig. 27 would be best for yam cultivation. The area centres on the parish of St. Thomas from where it extends in a southeasterly direction into the parish of St. George, covering part of St. John and the northern tip of St. Philip, northwards into the parish of St. Peter, eastwards into the parishes of St. Joseph and St. Andrew and westwards into part of the parish of St. James. The areas left out in the south and north are some of the driest parts of the island. The greater part of the Scotland District is also omitted because of the steep slopes and unfavourable soil conditions. It is found that the plantations showing a production of more than 6,000 lbs. of yam per acre (Table 3) fall within the optimal area of yam cultivation. If the peasant farmers and the plantation owners within these areas are encouraged to cultivate yam as the main food crop on their land, the production of yam with high yield per acre would go up quite considerably on the island.

Sweet potato is a more tolerant crop than yam in its water and even soil requirements. It will grow in areas where the annual rainfall is about 40 ins. It does not like very heavy rainfall and tends to produce more foliage than tubers in areas where the rainfall is greater than 70 ins. per annum. The periods of planting and growth are most critical in its cultivation when sufficient moisture should be available in the soil. The monthly distribution of rainfall during the planting period should have a lower quartile of not less than 3.5 ins. and that of the growing period should not be less than 6 ins.

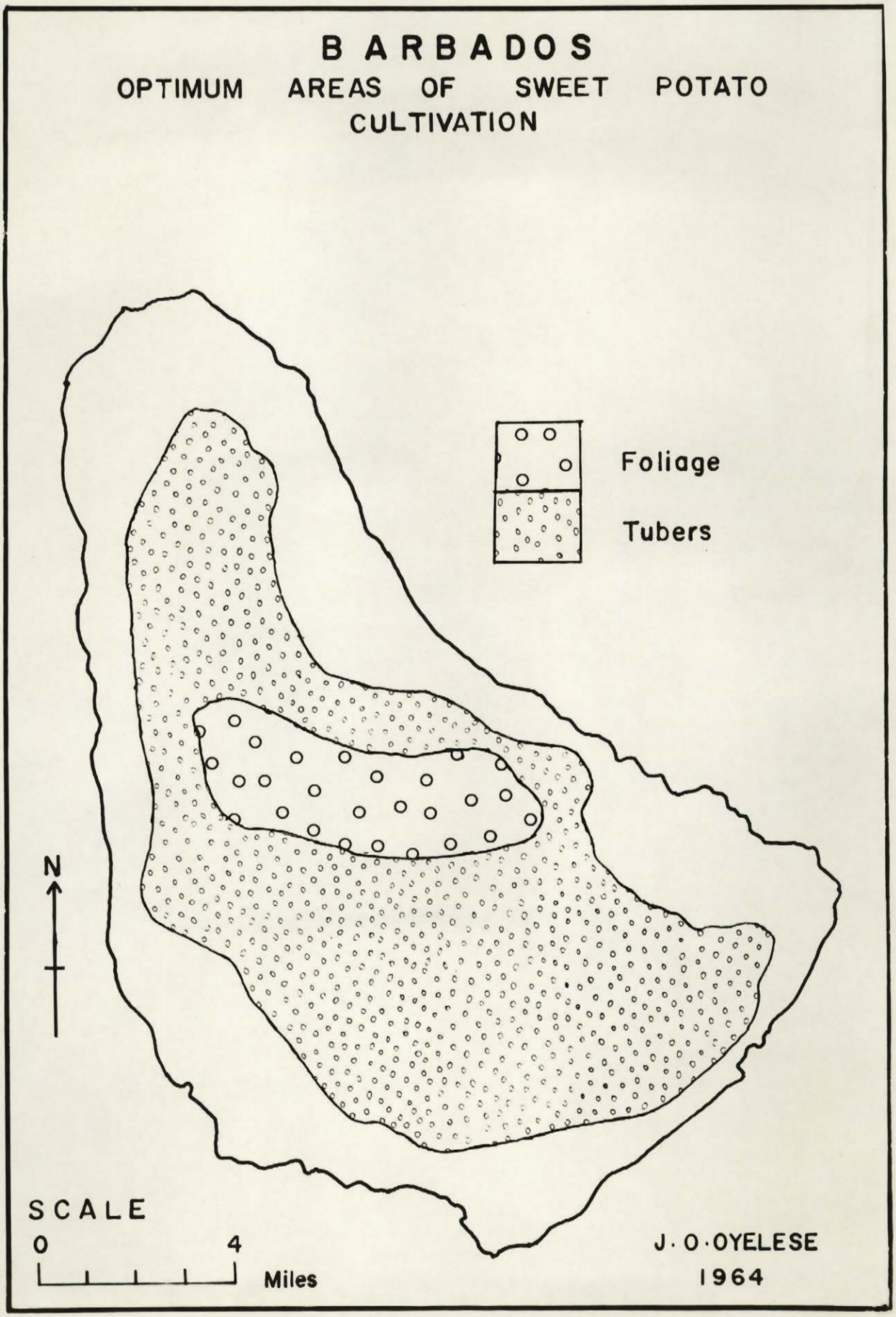
B A R B A D O S
OPTIMUM AREAS OF SWEET POTATO CULTIVATION
Foliage
Tubers
N
SCALE
0
4
Miles
J. O. OYELESE
1964

Figure 28

The soils most suitable for its cultivation are those with a fair proportion of sand in the top soil and a fairly moisture-retentive sub-soil. They should also be warm, friable and well-drained. Most soils on the island would satisfy these requirements adequately but those of the coastal belt of St. Philip, the Red sand of the western coast, the St. Philip association (which is not well-drained), and most of the soils of the Scotland District would probably give uneconomical yields. A second limiting factor in most parts of the Scotland District is the very steep slopes.

In the central part of the island there are some areas within the parishes of St. Thomas, St. Joseph, St. John and St. George, where the rainfall is over 70 ins. per annum and since, as has been aforementioned, higher rainfall tends to produce more foliage than tuber, the writer suggests that this area could be better used for such purposes thus providing foliage for livestock feed, a scarcity on the island. (Fig. 28).

The cultivation of corn can be carried out only once annually in most parts of the island, but the amount produced could be increased in almost all the areas. The lowest annual rainfall required for its cultivation is 45 ins. and there is hardly any area that would not satisfy this criterion. The tasselling and silking periods are most critical in its cultivation. They occur 53 to 70 days and 57 to 70 days respectively after the planting of the corn. During these periods, the monthly rainfall distribution should have a lower quartile of not less than 4 ins. and this condition is satisfied almost

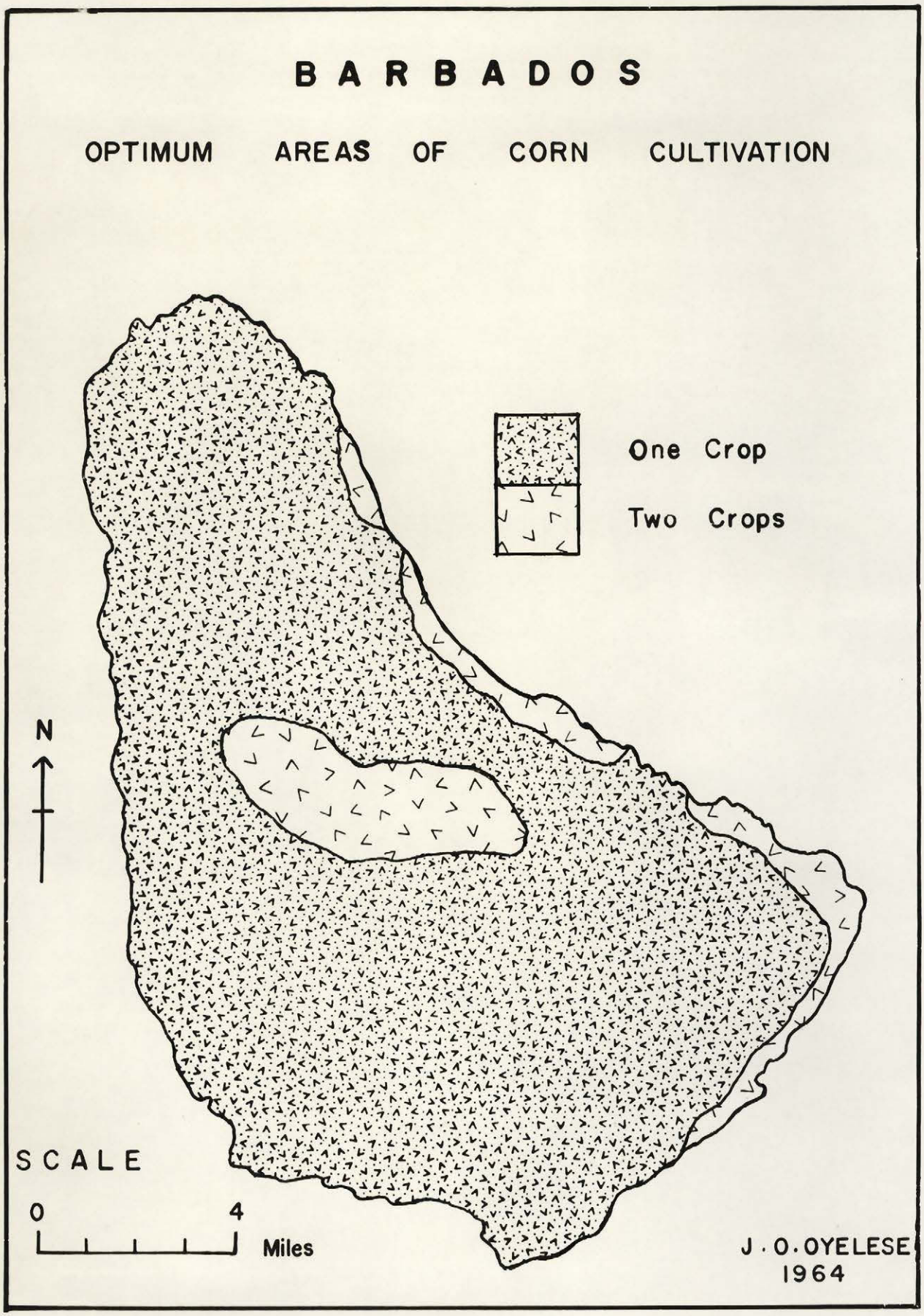
BARBADOS
OPTIMUM AREAS OF CORN CULTIVATION
One Crop
Two Crops
N
SCALE
0
4
Miles
J. O. OYELESE
1964

Figure 29

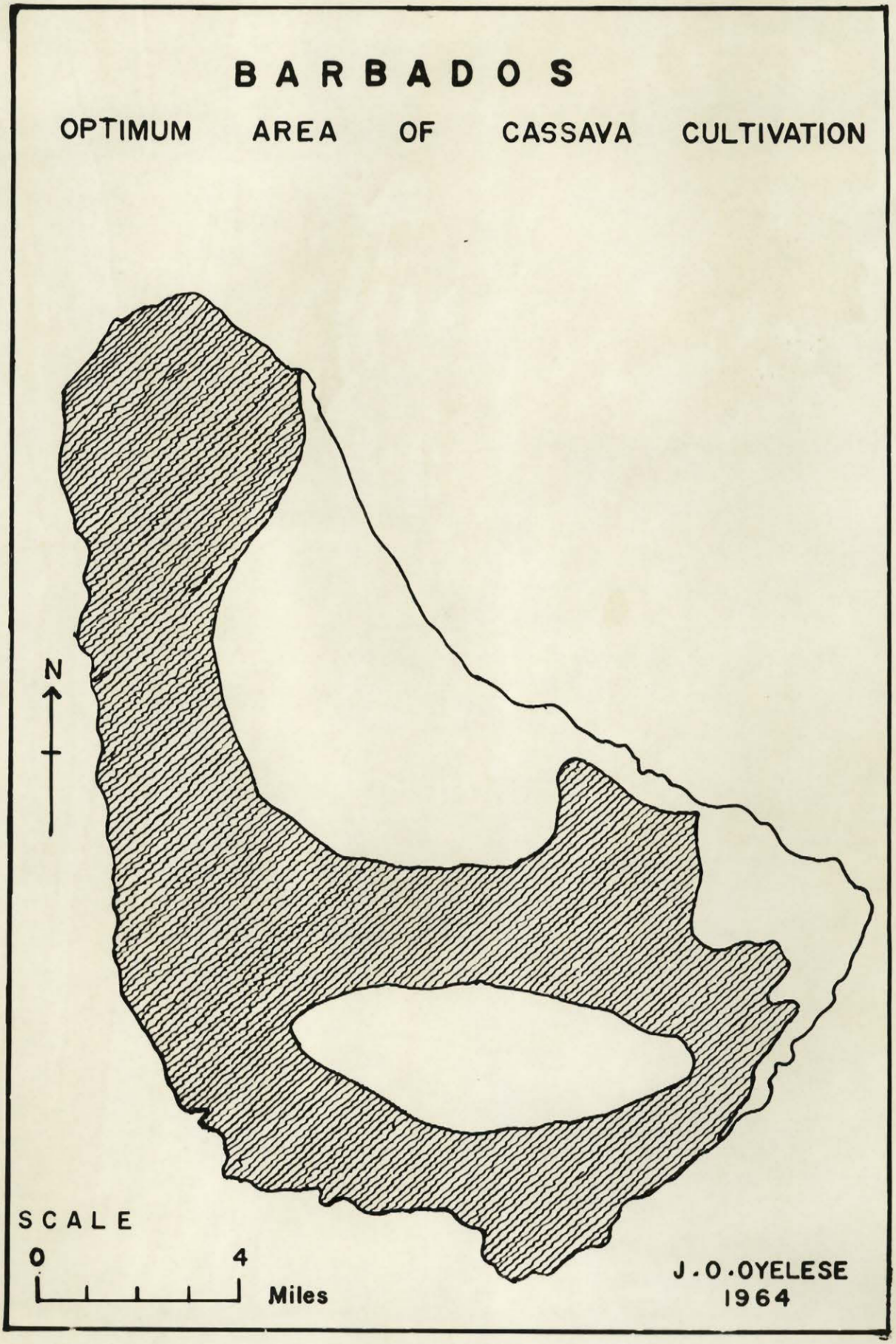
BARBADOS
OPTIMUM AREA OF CASSAVA CULTIVATION
N
SCALE
0
4
Miles
J.O.OYELESE
1964

Figure 30

all over the island. The central portion of the island shows a tendency to satisfy this condition twice in the year, and two crops of corn could probably be raised. The first crop could be planted in April and the second in August or September. (Fig. 29) The areas unsuitable for corn cultivation are those where the soil is saline, where there is little or no soil covering, and where it is undeveloped.

Cassava cultivation is not very popular and could hardly be expanded unless there is a market for its starch. The environmental conditions are generally favourable for its cultivation, except in such areas as the St. George Valley where the soil is rather heavy, the southeastern part of St. Philip and the Scotland District where saline soils and steep slopes prevent its cultivation. The crop is drought-resisting once it is established and this is an advantage in the drier parts of the island where it can be grown with little effort. If more use could be found for this crop, its production could be quite high in the areas shown in Fig. 30.

Eddoe requires a much higher annual rainfall for economic yield than do most of the other crops. The annual rainfall should be more than 65 ins. and the lower quartile of the monthly distribution during the growing periods of 5 to 6 months should be greater than 3 ins. It can be seen therefore that this is a rainy season crop on the island. The ideal soils for its cultivation are well drained loams and light soils.

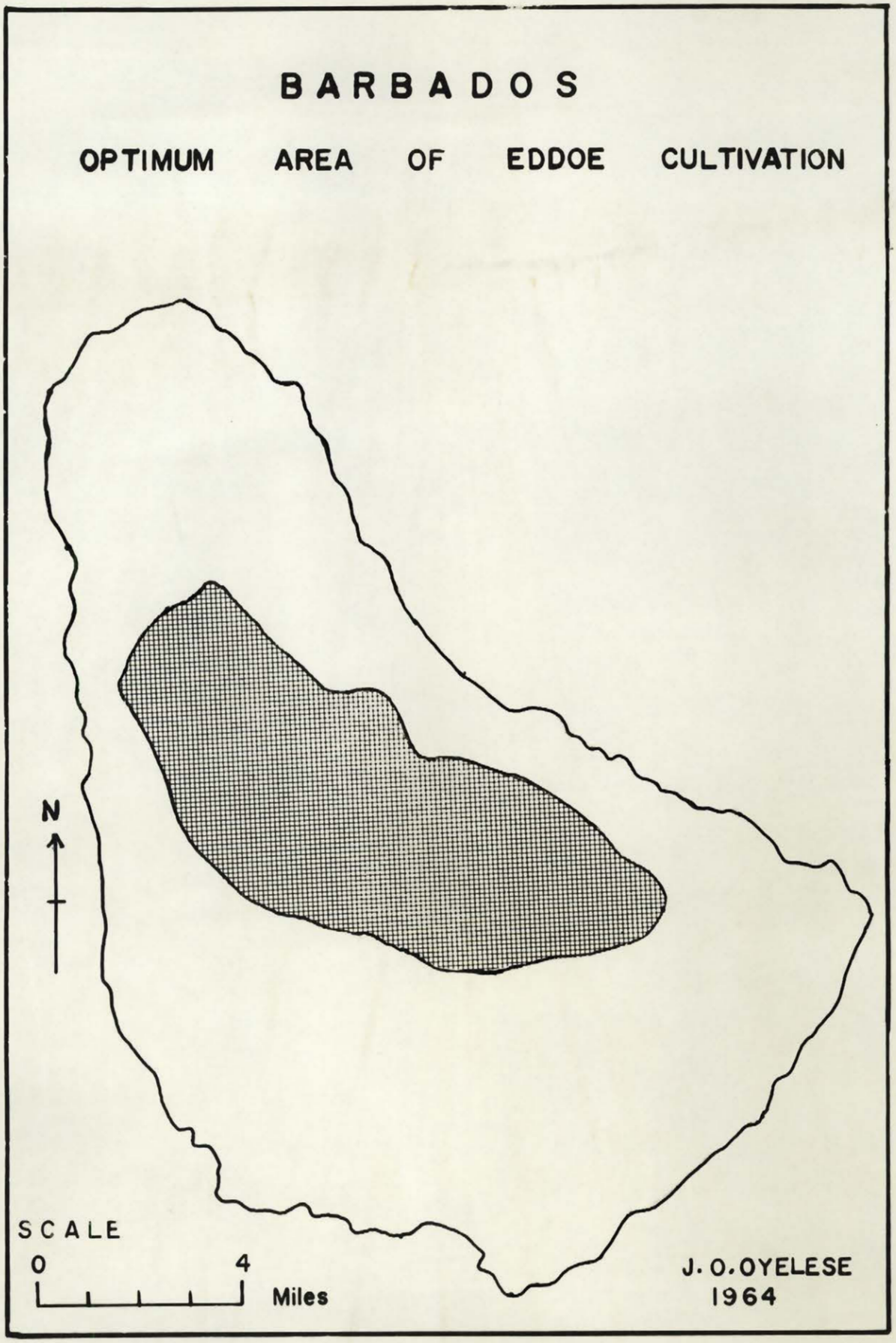
BARBADOS
OPTIMUM AREA OF EDDOE CULTIVATION
N
SCALE
0
4
Miles
J. O. OYELESE
1964

Figure 31

The above mentioned requirements for eddoe cultivation would limit the area of its optimum return to the central portion of the island which includes most of the parish of St. Thomas and parts of St. Peter, St. James, St. Joseph, St. John and St. George. (Fig. 31).

The cultivation of vegetables could be considerably expanded if increased irrigation facilities are provided. The position with the fresh water resources is not very satisfactory and with ever-increasing civilian demands being made upon it, the chances of water being made available for agricultural purposes are very remote. The possibility of holding more rain water in underground reservoirs for irrigation purposes is also doubtful as there is considerable seepage of water into the sea. It is therefore probable that the rainy season cultivation of vegetables, which do not require any irrigation, is the aspect of production that can be expanded.

The cultivation of tomatoes for export was experimented on in 1938 and according to records, about three shipments were made to Canada. This project was going to be properly organized but the second world war probably led to its being abandoned. The cultivation of this crop which was found suited to the environment could be revived if a market can be found for it.

The fruit requirements of the island are hardly satisfied by the local production and a large amount of fruit is still imported from the neighbouring

islands. It is interesting to note that even mango which can be grown quite economically on the island is still imported. There is a great opportunity for the cultivation of fruit trees, especially in the numerous gullies which indent the successive cliff-like escarpments rising in a sky-like fashion in the western section of the island. These gullies have deeper soils and they contain more moisture too. There are also several shallow well-protected depressions now planted in sugar cane that could be devoted to the cultivation of fruit trees. Some parts of the Scotland District, especially those adjacent to the Coralline Limestone area, also offer suitable sites for their cultivation. If all these areas are systematically planted with fruit trees, the island should be able to produce its fruit requirements and probably have some left over for export as well.

(ii) The Economic Aspects of Food Crop Production

The plantations and the peasants of Barbados are primarily concerned with the cultivation of sugar cane and the cultivation of food crops is only of secondary importance. Many authorities have deplored this state of affairs, but the writer feels that this cash economy, dependent on a single crop as it is, might yet be the first step in developing a more progressive system of peasant farming under which proper intensive cultivation of food crops would thrive. The food crops should not be produced for the home market alone, but rather, external markets should be found for the surplus which improved production is bound to bring.

As Dr. Jolly, A. L. [1] has stated, "If a farmer's consumption is circumscribed by the produce he can raise on the farm, the incentive for greater production is limited by physical appetite; if a large amount of the production could be realized into cash, the farmer has the choice of a wider variety of goods, both consumption and capital." One of the urgent considerations which could influence the peasants to increase production therefore is the possibility of cash return.

The yams and sweet potatoes produced on the island used to be exported to British Guiana until the market was closed in the early thirties. The effect of this closure was well recorded in the Agricultural Journal of April, 1936[2] which states : "The cultivation of sweet potatoes and other ground produce continues to feel the lack of an export market----- it cannot be emphasized too strongly what the closure of the British Guiana market has meant to Barbados". The lack of an outside market definitely lowered the production of these crops. The recent increase in the production of yams on the island is a pointer to the fact that if there is an external market, production would increase. The large number of West Indian immigrants to England has made the importation of yam into that country necessary, and

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1. Dr. Jolly, A. L. - "Peasant Farming" - Report on Peasant Experimental farms at the I. C. T. A., Trinidad - July, 1954.
2. Agriculture Journal - Department of Science & Agriculture, Barbados, Vol. 5, No. 2 - April, 1936.

according to records, about 392. 34 tons of yams were exported to England between 1st November, 1962 and 18th May, 1963. This figure would probably increase quite considerably during the 1963-64 crop season.

The importation of food materials into the island is another factor that may adversely affect the production of food crops and this is a matter to which the government should give some consideration. Barbados cannot be self-sufficient but the importation of food materials which can be produced locally and profitably should be discouraged. In this way the farmers would be assured of at least the home market and they would be encouraged to grow more food crops.

The lack of proper storage and preservation facilities is another limiting factor to the production of crops such as sweet potato. The difficulty in storage has led many farmers to produce just enough for their immediate needs. In the course of the sample survey, it was discovered that about 63% of the farmers interviewed did not store any type of food crops at all. About 49% of those who were left stored yams in their cellars and their maize on racks. In contrast, only about 1. 8% of the farmers store sweet potatoes for a few weeks. The farmers stated that yams stored in cellars could keep for about 6 to 12 months. They usually become wilted, however, due to loss of moisture, but the farmers maintained that if they are soaked in water after the period of storage, the lost moisture could be replaced. The corn is usually stored with the husk still on, and this protects

it from insect attack. On the whole, it could be concluded that a very little amount of the food crops produced on the island is stored. The farmers usually take their produce to the market immediately after harvesting, with the result that there is a glut since all the crop is offered for sale within a short time to prevent deterioration and/or loss in quality. This also results in their scarcity until the time of another harvest.

The introduction of simple, efficient and inexpensive storage methods into the island is one of the prerequisites of any substantial increase in the food production. The islands of the West Indies have not been lacking in experimental work on the storage of the important food crops like yam, sweet potato and corn. The Imperial College of Tropical Agriculture in Trinidad[1] has carried out several experiments on the storage of yam and sweet potato for several years. Some of these experiments relate to storage with the help of chemicals and others by the use of pits and racks. Storage with the help of chemicals would, however, be beyond the reach of an average peasant in Barbados whereas storing in pits and on racks are methods that could be developed and encouraged.

Jean S. Ingram and L. H. Green-Wood-Barton[2] advocated two methods of yam storage; the first is the storing of yams on shelves in a

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1. Ekanem, A.E. - 1959)
   Chukwueke, V.O. - 1956) A.I.C.T.A. Theses on Storage
   Okonkwo, G.T - 1960) of Yams and Sweet Potato.
   Teriba, F.A. - 1958)
   Walker, C.H.F -1936)
2. Ingram, J.S. & Green-Wood-Barton, L.H - "The Cultivation of Yams for Food" - Tropical Science - Vol. IV. No. 2 - 1962.

well ventilated and weather-proof house, and the second is storing on racks under the shade of trees. The first method is equivalent to the method now used by a few farmers on the island and could be improved further. The second method has been used in parts of West Africa for a very long time and has been found to be quite efficient. The rack is made of "living posts" which might be trees already growing in the area, or just erected, to form vertical upright supports. These living posts provide shade for the stored yams with their leafy growth. The posts are arranged in two rows, very close together, with long cross poles placed in position to the vertical poles and tied. The space left between each pair of erect poles is approximately 2 to 4 feet and between the horizontal poles 1 to 2 feet. As the yams are brought in they are tied one by one to the erect poles, beginning at the bottom. They are usually strung up on both sides of the upright pole in such a way that they are kept slightly apart. It is important that the yams are washed and aired for a few hours before they are stored. This method has a few advantages; it prevents the spread of diseases from infected tubers to healthy ones and it also provides adequate ventilation and uniform temperature. It should not be very difficult to use on the island since the same construction could be used year in and year out.

The storage of sweet potato is not easy because of its tendency to sprout very soon after harvesting. It has little or no dormancy period and it loses from 4% to 5% and up to 10% of its weight in the first week and the first fortnight respectively after harvesting.

Many experiments in storage methods were carried out with the different types of sweet potato grown in the West Indies and all the results tended to establish that pit storage is the best for this crop. Incidentally, some of the farmers in Barbados use a type of pit storage but this needs much improvement. The pit storage method suggested by Halcrow, M.[1], is probably the easiest that could be adopted. The pit, he said, should be rectangular, about 18 ins. in depth, and lined with cane trash. The tuber should then be put in to about 4 ins. of the surface and covered with cane trash and soil up to the level of the ground. A roof should be erected over this pit to keep off rain and sun and to check temperature fluctuations.

In the United States[2] potato is stored in specially built storage houses kept at a suitable temperature. This method is preferable to the pit method but it is very expensive. Some of the plantations on the island could probably afford this either individually or on a cooperative basis. As far as the peasants are concerned, it is only the government that could initiate this storage method through its Marketing Board.

The success of any storage method depends partly on some factors

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1. Halcrow, M. - "Sweet Potato Storage Trials" - I. C. T. A. Thesis, Trinidad, 1932-33.
2. Gross E. R. - "Sweet Potato Storage Houses" - New Jersey Agricultural Experimental Station - Circular 359 - 1935. Lutz, J. M. & Simons, J. W. -"Storage of Sweet Potatoes", U. S. Department of Agriculture - Farmers' Bulletin No. 1442.

which are within the control of the farmer. The farmer must make sure that the tubers are well matured before harvesting; they must be carefully handled so that no damage is done to their skins; all damaged or infected tubers should be removed; and they must be well-dried and cured before storage. If these precautions are taken, sweet potato could be stored for up to three months by using the pit method. This period of storage is long enough to provide a supply of sweet potato on the island almost all the year round, as the crop is a biennial one.

It is relatively easier to store corn on the island. The peasants have discovered quite rightly that corn stored in the husk is usually free from insect or animal attack. When corn is produced in a large quantity, however, it might not be easy and practicable to keep everything on racks in the house. The peasants of West Africa make use of a conical mud hut for the storing of their corn. The corn is put in the hut with their husk still on; the top of this hut is sealed with mud after it has been filled, and a grass tent is constructed over it to protect it from rain and excessive heat. The corn could be kept in this way for about two years without getting spoilt. Such a method could be adopted in Barbados with some modifications.

If the problem of storage could be solved on the island, the market need not be glutted with food materials after harvest. There would also be a steady supply of these food materials throughout the year and the farmers would be able to sell at a more profitable price.

(iii) The Land Tenure System

The Land Tenure system is an important factor in the efficient production of food crops on the island. The system now common among the peasant farmers could be a great obstacle in the way of intensive cultivation. This trait in the system i s that of fragmentation which could be attributed to these two social factors in Barbados; (i) the law of inheritance, and (ii) the efforts of the peasant to build up his farm piece by piece as land becomes available and his savings permit. Then come the problems of absentee owners, squatters and renters on plantation lands.

The law of inheritance sometimes necessitates the division of the small peasant holdings into still smaller pieces and this process may continue until the plots cannot be cultivated economically. The peasant would probably end up in the city looking for employment like several hundred others while the land is left to waste. It seems, however, that this danger is fairly appreciated on the island for the writer came across several farms operated on a joint basis by brothers and sisters. It is the second type of fragmentation that may affect the efficient production of food crops on the island quite significantly. This type of fragmentation could not make for efficient cultivation for many reasons; (i) the distance the farmer would have to travel whenever he wishes to cultivate the land; (ii) the limitation of implements caused by this distance; (iii) the cropping of the land in food crops being restricted because of the danger of larceny: (iv) pen-

manure not being able to be used on such farms except the farmer has the facilities for transporting it: and (v) the fact that the farmer would not be able to give full attention to the cultivation of the crops, and this is the greatest potential advantage of small scale farming.

Lands farmed for absentee owners are normally not well cared for because the peasant is always conscious of the fact that the land could be taken away from him without any notice even with a crop still growing on it. The squatters and renters are also conscious that they hold the land at the risk of being able to pay the usual rent and this sense of insecurity would, in a way, affect the standard of cultivation.

It might be unrealistic to talk of altering these trends in the land tenure of the island, but perhaps they could be arrested. This, obviously, would prove a difficult proposition on a politically conscious island like Barbados. It should be realized, however, that the prospect of increased production depends on the efficiency of cultivation which, in turn, depends on the system of land tenure.

All these considerations pose the questions of how much increase in the cultivation of food crops is advisable on the island, and what type of crops should be cultivated extensively. The hypothetical areas of optimum production shown in the maps indicate that all the ground provisions, except eddoe, could be cultivated extensively. It has also been shown

that the cultivation of fruit trees could be expanded if the gullies and the depressions are set aside for this purpose. The food material requirements of the island and the size of the external markets where surplus produce could be sold would ultimately limit the extent to which the cultivation of these crops could be expanded. The areas of land now occupied by sugar cane are limiting factors but, in the opinion of the writer, these areas need not be reduced as the remaining land could be used to produce enough food crops if the peasants could get more capital and practise a more efficient system of cultivation.

The question of capital is very important as this is one of the major obstacles to increased production. If the cultivation of sugar cane is continued and there are assured markets for the food crops produced, the peasants would accumulate the necessary capital needed for further development.

CHAPTER VII

GENERAL CONCLUSIONS AND SUGGESTIONS

THE PRESENT POSITION

The production of food crops in Barbados at the present time falls short of what the island is capable of producing. Many reasons have been suggested for the poor condition of food crop cultivation and the most significant of these are the emphasis placed on sugar cane cultivation and the lack of consideration of the suitability of environmental factors in cultivation.

The introduction of sugar cane definitely pushed the cultivation of food crops to the background and for a long time only the peasants cultivated any type of food crop. The land available for the cultivation was also not among the best on the island. The good price fetched by sugar cane, which enabled the peasants to purchase imported food materials, is yet another important factor that reduced production. The plantations have been compelled through the Production Order to plant 12% of their land in food crops, but this move has not improved the position substantially.

A consideration of the distribution pattern of food crop cultivation on the island also shows that the potentialities of the island have not been

fully utilized. The cultivation of these crops on peasant holdings is mainly for subsistence and the peasants therefore plant as many varieties as they can. Most of the food crops unfortunately would grow anywhere on the island although their yield varies according to the location. The plantations, on the other hand, are compelled to cultivate the food crops irrespective of whether or not their locations are suitable for them. The result of this is shown in the variations in the yields of yam on certain plantations chosen all over the island (Table 3).

The present apathy towards food crop production has cometimes been blamed on the lack of a home market and an external market. The lack of adequate production has recently created a substantial home market which, according to the Minister of Agriculture in a recent speech, "needs to be supplied with the finer vegetables, with root crops and with fresh fruit, mainly bananas; and this market has been estimated at about $2,000.000."[1] . This revelation is very encouraging and makes the necessity for increased production more urgent. The question of the external market is, however, more difficult and can only be looked into by the Marketing Board. There is a new market in England for Barbados' yam, created by the influx of thousands of West Indians into England during the past few years. This market could be stabilized and possibly expanded by careful planning.

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1. The Advocate - Barbados, W.I. - December 14, 1963.

THE SITUATIONS NEEDING ATTENTION

Some writers on the production of food crops on this island have suggested a reduction in the areas of land now cultivated in sugar cane. The writer feels that this is a sound suggestion as it would invariably help to step up production. It has been observed, however, during the course of the sample survey that this is not the only possible solution since the areas under food crop cultivation now can produce enough for the island and a little more for export if proper cultivation methods are introduced. In order that this might be possible some aspects of production have to be examined so that the earlier mistakes might not be repeated.

The aspects of cultivation which need more attention in Barbados are: (i) the pattern of cultivation distribution with respect to the environmental factors affecting crop growth; (ii) the introduction of intensive cultivation methods; (iii) the reorganization of advancing loans to the peasants for irrigation purposes and the possibility of increasing the land put under irrigation; (iv) the provision of storage facilities for food crops; and (v) the improvement of the marketing system on the island.

(i) The reorientation of cultivation distribution on the island could be started with the plantations. The present Production Order specifies the types of crops to be planted and even when they should be planted and harvested. An additional clause could be inserted specifying which crop

should be planted on plantations situated in particular localities according to the nature of the environmental factors obtaining there. The writer has indicated the areas optimum for the cultivation of each crop and this can serve as a guide in determining which crop to cultivate in the different areas.

It is very likely that within a short time the peasants will copy the plantations and the recommended crop would be cultivated on their holdings. The Extension Officers could also be of help in educating the peasants as to the advantages of the alteration in cultivation.

(ii) Although the peasant farmers of Barbados rank among the best in the world in their cultivation practices and their understanding of the necessity and the use of both animal manure and fertilizers, yet their holdings are not intensively cultivated. This could be explained partially by sugar cane cultivation, a crop which demands very little attention once it has been well established. The peasants therefore devote much time to part-time jobs that take them away from their plots. Since the proper cultivation of certain food crops would demand the full attention of the peasants, they should be given direct instructions on intensive farming.

The government has indicated recently that it would establish demonstration farms all over the island. While this is a good move, it is felt that the farmers would benefit more if they are made to participate in

such a project directly. As a start, the government could make more ploughs available to the peasants and could also help in the supplying of fertilizers. The number of Extension Officers on the island could also be increased.

(iii) Irrigation is a very important factor to cultivation in the drier areas of the island. The government has provided some irrigation facilities for the peasants in these areas and in 1963 about 185 such farmers were listed. (Table 4). The grant given was meant for the sinking of wells and the erecting of overhead pumps or windmills for this purpose. The progress report on this project, however, indicated that there was no appreciable improvement in irrigation in those areas. This lack of improvement was traced to the fact that the cost of irrigating individual farms has gone up due to the increase in the cost of equipment and labour. It was pointed out however that if the farmers operate in groups, the cost of irrigation could be cut by more than 600%. It is therefore suggested that the government policy on irrigation could be based on cooperative farming.

There is a lot of water now used for illegal and unfruitful irrigation on the island. The water is allowed to run freely on the ground but due to the inherent nature of some soils the water does not sink and it is therefore useless for crops. A lot of water is also presently being wasted in homes and this could be stopped by adopting a quota system. If each person on

TABLE 4

DISTRIBUTION OF IRRIGATION FACILITIES

PARISH	NO. OF FARMERS
St. Michael	91
Christ Church	41
St. James	21
St. Philip	16
St. Peter	5
St. George	3
St. Andrew	3
St. Lucy	2
St. Joseph	2
St. Thomas	1
	185

the island is allowed a certain quota free of charge and any amount of water consumed in excess of it is chargeable according to a specified rate, a lot of water would be conserved for irrigation. This measure, which would not be popular, is necessary in Barbados where the water reserve is limited and has to satisfy greater demands in the near future.

(iv) The increase advocated in production of food crops brings into prominence the question of storage facilities on the island. Sweet potato, a prominent food material, is very difficult to store and the best storage method, namely a "storage house", is not within the financial reach of the peasants. The Marketing Board could, however, give some consideration to the provision of such a facility. The storage of yam could be undertaken fairly easily by the peasants if they use the rack method recommended earlier in the thesis. The provision of good storage facilities would undoubtedly encourage more production and would also provide a steady supply of the different food crops in the market almost all the year round.

(v) The Marketing Board set up by the government is not yet functioning properly but when it is, it will undoubtedly help in the disposal of crops produced on the island. An aspect of marketing at present on the island which might not be conducive to increased production is the "price control". While this safeguard was necessary during the war period when it was

introduced, it is now being resented by farmers and some of them quote it as an excuse for not producing more food crops. If this measure is revoked, it is felt that the economic law of demand and supply would regulate the prices of the food materials.

THE FUTURE

The future of food crop production in Barbados might depend very much on the government policy on agriculture. The Minister of Agriculture in Barbados summarized this at a recent Agricultural Exhibition thus: "The government policy (concerning agriculture) is directed towards getting as much production out of the land, increasing output per acre of cultivated land, and restoring some dignity to agriculture---- -".[1] He further explained that diversification in agriculture does not imply the elimination of sugar cane but rather an intensification of production by getting more out of the land by producing a greater variety of crops to supplement, not eliminate, sugar cane.

The government in carrying out this policy should not overlook the inherent difficulties of the peasants which are: lack of land and lack of capital for development. The average size of a peasant holding on the island is less than 1 acre, while at the other end of the scale are the plantations with more than 300 acres in most cases. Under these circumstances the

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1. The Advocate - Barbados, W.I. - December 13, 1963

government cannot dodge indefinitely the question of purchasing and subsequently splitting up of marginal estates on the island. This step would necessitate the formulating of a bold scheme for resettling peasants on such estates but this should not prove very difficult since the government could borrow from the experiences of neighbouring islands such as St. Vincent. The peasants could either be encouraged to practise cooperative farming during the earlier stages of resettlement under the plantation system or individual holdings of about 10 acres each could be allocated to them. The peasants would need some training in farm management, and also initial capital for development. The cost of the land, and the capital given could then be deducted annually from the sales of crops after the farms have been properly established. The land tenure should also be such as to make fragmentation of the farms impossible.

Barbados needs some crops that could be supplementary to sugar cane and banana seems to be assuming this role gradually. The government has a very ambitious scheme for banana cultivation and this was clearly shown by the importation of about 4,000 Lacatan banana "suckers" from St. Lucia in December, 1963. The banana scheme seems to be a "high risk" on a wind-swept island like Barbados, nevertheless the distribution pattern revealed in the sample survey indicates that it could be cultivated profitably in some areas.

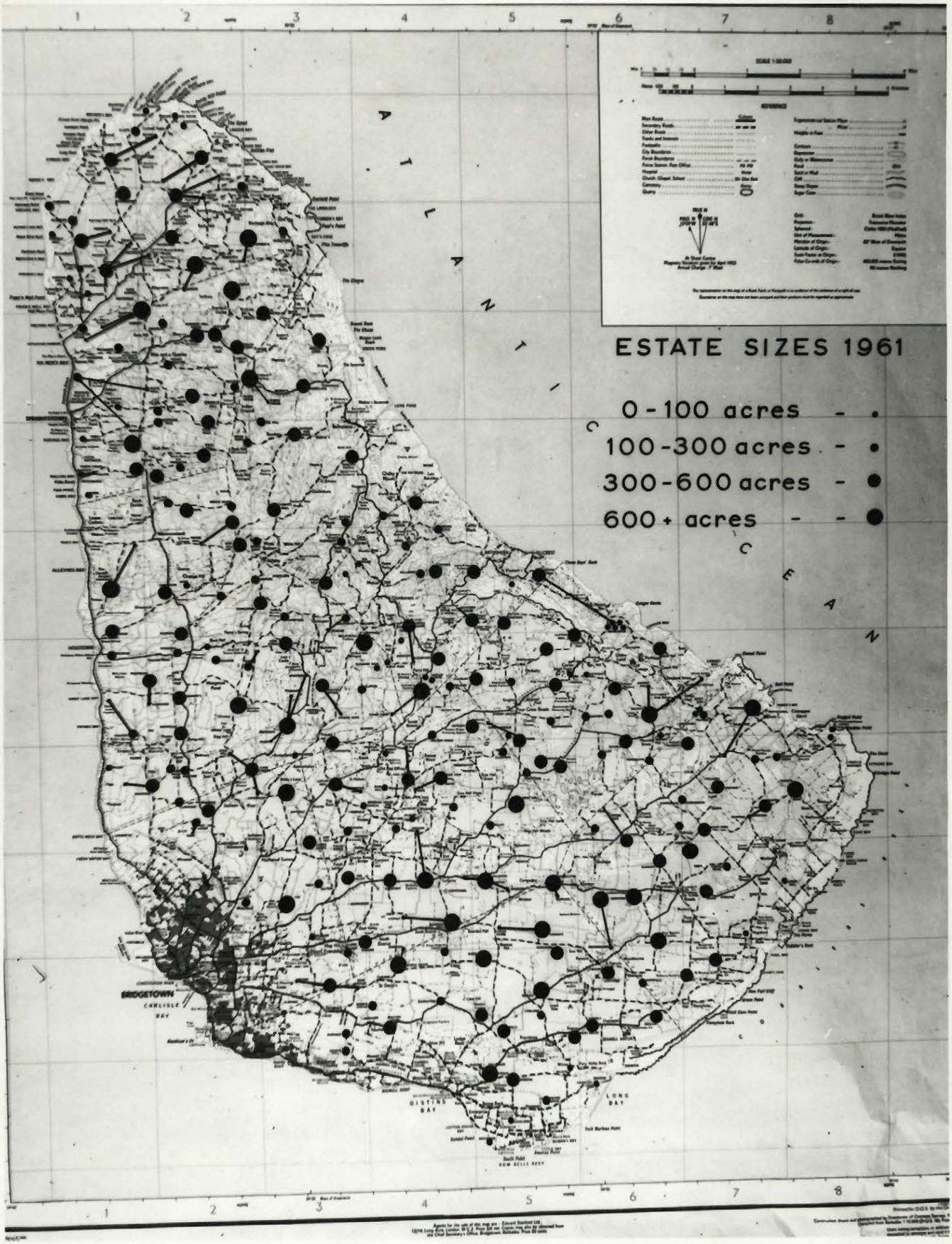
ESTATE SIZES 1961
0 - 100 acres
100 - 300 acres
300 - 600 acres
600 + acres
BRIDGETOWN
CARLISLE BAY
OISTINS BAY
LONG BAY
ATLANTIC OCEAN

Figure 32

The cultivation of winter vegetables especially tomato, for North American markets could also be investigated.

The cultivation of food crops on estates could be increased as more land than the 12% now specified in the Production Order has been cultivated by many plantations all over the island. It is likely that the expansion of the home and foreign markets would do this and further legislation might not be necessary.

This research project is mainly a pioneering effort at discovering some of the problems confronting food crop cultivation on the island. In spite of the limitations imposed by the scarcity of yield data, it has been revealed that the present pattern of cultivation distribution needs a change if production has to increase. There is a vast field for investigation on food crop cultivation on the island and if a definite programme of further research is formulated the island of Barbados would benefit greatly.

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APPENDIX I

LIST OF FOOD CROPS CULTIVATED IN BARBADOS

GROUND PROVISIONS

Yam	Dioscorea alata
Sweet Potato	Ipomoea batatas
Corn (Maize)	Zea mays
Cassava	Manihot utilissima
Eddoe	Colocasia antiquorum
Dasheen	Aloeasia xanthosonia
Guinea Corn (Sorghum)	Sorghum vulgare
'Irish' Potato	Solanum tuberosum

FRUIT TREES

Banana	Musa cavendishii
Breadfruit	Artocarpus incisa
Plantain	Musa paradisiaca
Mango	Mangifera indica
Avocado Pear	Persea americana
Pawpaw	Carica papaya
Guava	Psidium guayava
Custard Apple	Anone squamosa
Grapefruit	Citrus paradisi
Lime	Citrus aurantifolia
Sweet Orange	Citrus sinensis
Lemon	Citrus limonia
Sour Orange	Citrus aurantium
Shaddock	Citrus maxima
Tangerine	Citrus nobilis
Coconut	Cocos nucifera
Pineapple	Ananas comosus
Soursop	Anona muricata
Sugar Apple	Anona reticulata
Sapodilla	Achras zapote
Mammea apple	Mammea americana
Cashew	Anacardium occidentale
Genip	Melicocca bijuga
Tamarind	Tamarindus indica
Golden apple	Spondias mombim

VEGETABLES

Cabbage	Brassica oleracea
Carrot	Daucus carota
Cucumber	Cucumis sativus
Cow Pea or Christophene	Sechium edule
Eggplant	Solanum melongena
Eschalot	Allium ascalonicum
Lettuce	Lactuca sativa
Lima Bean	Phaseolus lunatus
Okra	Hibiscus esculentus
Pumpkin	Cucurbita pepo
Pigeon Pea	Cajanus cajan
Runner Bean	Phaseolus coccineus
Tomato	Lycopersieon esculentum
Vegetable marrow	Cucurbita maxima
Shallot	Allium ascalonicum
Kohlrabi	Coulorapa brassica
Onion	Allium cepa
Beet	Beta vulgaris
Cauliflower	Brassica botrytis
Jerusalem Artichokes	Helianthus tuberosus
Globe Artichokes	Cynara scolymus
Ground Nut	Arachis hypogea

SEASONINGS

Ginger	Zingiber officinalis
Horseradish	Cochlearia armoracia
Marjoram	Origanum vulgare
Mint	Mentha spp.
Parsley	Petroselinum sativum
Red Pepper	Capsicum frutescens
Thyme	Thymus vulgaris
Tumeric	Curcuma longa
Rosemary	Rosemarinum officinalis
Savoury	Satureja hortensis
Sage	Salvia officinalis

APPENDIX II

SPECIES INTRODUCED INTO BARBADOS, LISTED IN APPROXIMATE CHRONOLOGICAL ORDER OF ENTRY*

		First Noted
Cassava	Manihot esculenta, Grants	1627
Yam	Dioscorea sp. (probably D. alata)	1627
Indian	Zea mays	1627
Plantain	Musa paradisiaca	1627
Banana	Musa paradisiaca var. sapientum, Kuntze	1627
Orange	Citrus sp.	1627
Lemon	Citrus limonia, Burman	1627
Lime	Citrus aurantifolia, Swingle	1627
Pineapple	Ananas comosus	1627
Melon	Cucumis melo	1627
Tobacco	Nicotiana tabacum	1627
Pulses		1627
Potato	Solanum tuberosum	1631
Water Melon	Cotrillis vilgaros, Schrader	1631
Pawpaw	Carica papaya	1631
Coconut Palm	Cocos nucifera	1647
Thyme	Thymus vulgaris	1647
Sweet Marjoram	Majorana hortensis, Moench	1647
Parsley	Petroselinum crispum, Nyman	1647
Onion	Allium cepa	1647

* Extracts from Watts, D. Thesis - McGill University, Ph.D. Thesis, 1963.

		First Noted
Cabbage	Brassica oleracea var. eapitate	1647
Turnip	Brassica rapa	1647
Radish	Raphanus sativus	1647
Lettuce	Lactuca sativa	1647
Guinea corn	Sorghum vulgare	1665
Shaddock	Citrus grandis, Osbeck	1684
Pigeon Pea	Cajanus cajan, Millspaugh	1684
Callavants or Cow Pea	Vigna sinensis, Svi	1690
Sweet Orange	Citrus sinensis, Osbeck	1690
Mango	Mangifera indica	1690
Okra	Hibiscus esculentus	1695
Tomato	Lycospericon esculentum	1720
Eggplant	Solanum melongena	1750
Roasting Eddoes	Colocasia esculenta, Schott	1750
Scratching Eddoes	Colocasia esculenta, Schott	1750
Blue Eddoes	Colocasia esculenta, Schott	1750
Sweet Potatoes	Ipomaea batatas, Lamarck	1750
Avocado or Alligator Pear	Persea americana, Miller	1750
Ground Nut	Arachis hypogaea	1750
Pumpkin	Cucurbita pepo	1750
Black Pepper	Piper nigrum	after 1764
Breadfruit	Artocarpus altilis, Fosberg	1790

APPENDIX III

No. A. G. 1 Vol. VII/141

LOCAL FOOD PRODUCTION (DEFENCE) CONTROL ORDER, 1942, NO. 2

*Notice to Owners of Plantations issued by the Competent Authority under Articles 4 (1) and 5 (1) of the Local Food Production (Defence) Control Order, 1942, No. 2

During the 1963-64 crop year differentiation will be made between the two distinct areas of the Island known respectively as the Coralline Limestone Area and the Scotland District. The directions issued in this Notice for planting food crops and for rearing livestock are different in respect of these two areas. The area in which each individual plantation lies, as determined by the Competent Authority is stated in the Notice.

2. In either of these two areas:-

(a) plantations may be grouped to form a unit, but no such grouping shall be permissible without the prior approval in writing of the Competent Authority:

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*Attention is especially drawn to the definition of the word "owner" in the Local Food Production (Defence) Control Order, 1942, No. 2 which reads as follows:-

"Owner" includes any person in this island having possession or charge of any plantation or any small holding, attorneys, agents of owners, receivers in chancery, and tenants.

(b) "preparation land" means land which is being cultivated with a view to planting sugar cane therein during the 1963 sugar cane planting season:

(c) "1963-64 Crop Year" means the period extending from the 1st June, 1963, to 31st May, 1964.

FOOD PRODUCTION IN THE 1963-64 CROP YEAR

A. Coralline Limestone Area

(i) Crops

3. By virtue of the provisions of Article 4 (1) of the Local Production (Defence) Control Act 1942, No. 2, you are hereby required to plant and cultivate and harvest vegetables during the crop year 1963-64 in a total of twelve per centum of your arable acreage, which must include a minimum of three per centum of thrown-out land. Such vegetables must be planted in accordance with the requirements set out in paragraph 4 and in the Appendix to this Notice.

4. The vegetables to be grown and percentages of each are as follows:-

(a) Preparation Land:-

Crop	Percentage to be grown
Any vegetable crop, including yams, sweet potatoes, corn for green or dry grain, peas, beans, eddoes and green vegetables	100

(b) In thrown-out Land:-

Crop	Percentage to be grown
+Sweet Potatoes	100

5. The following categories of land planted with vegetables prior to the 1963-64 crop year may be regarded as part of the twelve per centum of arable acreage mentioned in the third paragraph of this Notice, provided that the kind and amount of such vegetables are within the requirements laid down by this Notice.

(a) land thrown-out for the 1962-63 crop year and planted with a vegetable crop additional to the requirements of any Notices issued in respect of such crop year;

(b) land in preparation for the 1963-64 cane crop;

(c) land to be thrown out for the 1963-64 crop year.

6. For the purposes of this Notice:-

"Thrown-out land" means arable land in which no sugar cane is grown for a minimum period of sixteen months after the close of the reaping of the 1963 crop.

+In scarabee areas only.

(a) the entire area of "thrown-out" land potatoes may be replaced by cassava planted in accordance with the conditions specified in the Appendix to this Notice or

(b) an area not exceeding one-half the area of "thrown-out" land potatoes may be replaced by Sea Island cotton planted in July 1963 in accordance with the conditions specified in the Appendix to this Notice, to be followed in the same area by yams and Indian corn to be planted in May-June 1964.

In either case replacement of sweet potatoes may only be undertaken with the written permission of the Competent Authority in reply to a written request for such replacement.

(ii) Livestock

7. By virtue of the provisions of Article 5 (1) of the Local Food Production (Defence) Control Order, 1942, No. 2, you are hereby required to keep livestock on your plantation as follows:-

To every twenty acres in your total acreage	-	One ox or one bull or one cow or one heifer or one pig, or five sheep

8. With the exception of livestock used or intended for breeding purposes, the ages of the cattle and sheep kept for the purposes of this Notice must not exceed two years and one year respectively.

B. Scotland District

(i) Crops

9. By virtue of the provisions of Article 4 (1) of the Local Food Production (Defence) Control Order, 1942, No. 2, you are hereby required to plant and cultivate and harvest vegetables during the crop year 1963-64 in a total of seven per centum of your arable acreage in "preparation land" only. Such vegetables must be planted in accordance with the requirements set out in the Appendix to this Notice.

(ii) Livestock

10. By virtue of the provisions of Article 5 (1) of the Local Food Production (Defence) Control Order, 1942, No. 2, you are hereby required to keep livestock on your plantations as follows:-

(a) one ox or one bull or one cow or one heifer or one pig or five sheep to every twenty acres in your total acreage;

(b) in addition, one ox or one bull or one cow or one heifer to every acre in the total number of acres equal to six per centum of your arable acreage.

11. With the exception of livestock used or intended for breeding purposes, the ages of the cattle and sheep kept for the purposes of this Notice must not exceed two years and one year respectively.

EXPORT OF SWEET POTATOES AND YAMS

12. Export of sweet potatoes and yams will be permitted except in times of local shortage.

Competent Authority.

. . . . . .

. . . . . plantation situated in the

. . . . . .

Date . . . . . .

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* Attention is especially drawn to the following subsection of the Local Food Production (Defence) Control Order, 1942, No. 2 -

"For the purposes of any Notice issued to the owner of a plantation under the provisions of paragraph (1) of this article no livestock shall be deemed to be kept in compliance with the requirements of such Notice unless the same is the exclusive property of the owner, manager or overseer of the plantation, and is kept on the plantation."

LOCAL FOOD PRODUCTION (DEFENCE) CONTROL ORDER, 1942, NO. 2

Appendix to the Notice No. A. G. 1 Vol. VII/141 regarding the Planting of Vegetables during the 1963-64 Crop Year

N. B. Spacings wider than those in the Instructions given below may be used, but in that event a proportionally larger acreage must be planted.

1. YAMS. These must be planted as early as practicable, and not later than 15th July unless permission to do otherwise is given by the Competent Authority, at a rate of one plant to the cane hole. The varieties grown must be of the Lisbon type, except that others such as Horn, Oriental and Crop (Hunt) may be grown, on condition that these do not exceed one-fifth of the total required acreage. Yam plants must each weigh not less than 4 oz. Lisbon Yams must not be harvested before the 1st of January, 1964.

2. EDDOES. These must be planted not later than 31st July, unless permission to do otherwise is given by the Competent Authority, at the rate of one plant per cane hole.

3. CORN. This must be planted at the rate of two chops per cane hole, and seed free from bacterial stripe disease only used. Corn in preparation land must be planted not later than 30th September, and should be manured at the rate of 2cwt. of sulphate of ammonia an acre.

4. SWEET POTATOES. These must be grown from pest-free planting material, at the rate of three slips to the cane hole, and should be planted

as early as practicable in preparation land in order to get the early market. In thrown-out land in the parishes of St. Michael, Christ Church, St. Philip, St. James and St. Lucy, they must be planted not earlier than 1st September and not later than 31st October. In all other parishes they must be planted not earlier than 1st September and not later than 30th November. The varieties to be grown must comprise one or more of the following:- B.44, Black Rock, White Gilkes, V.52, Caroline Lea, B.5. Except with the permission of the Competent Authority in writing, sweet potatoes planted in "preparation land" must not be harvested at less than fourteen (14) weeks from planting, and those planted in "thrown-out" land must not be harvested at less than sixteen (16) weeks from planting, and in no circumstances before 1st March, 1964.

5. CASSAVA. This must be grown from disease and pest-free planting material only, at the rate of one plant per cane hole and planted by 30th September at least.

6. PEAS AND BEANS. For the purpose of this Notice, 'peas and beans' includes Rounceval and Black-eye peas and all other forms of cow-peas, local and imported Lima beans, broad beans, bonavist and ground nuts. In preparation land these must be planted not later than 31st July at spacing distances given by the Competent Authority.

7. GREEN VEGETABLES. For the purpose of this Notice, 'green

vegetables' includes okras, onions, chives, shallots, tomatoes, lettuce, cabbage, cauliflower, Irish potatoes, beetroot, kohlrabi, carrot, stringless beans and any other vegetable approved as a green vegetable by the Competent Authority. Green vegetables must be planted in accordance with the spacing distances given by the Competent Authority.

8. SEA-ISLAND COTTON. The land should be properly forked, cane holed and weeded. Two rows of cotton plants should be planted on the banks between the cane holes, the cotton chops being about 20 inches apart in each row. This means that the double rows will be 2-1/2 feet apart with approximately 3 feet between each double row. Proper thick wind-breaks of Guinea corn or Imphee, 4 to 5 rows, should be planted to protect the young cotton crop from the prevailing winds. At the time of planting six to eight seeds should be placed in each cotton chop and when the crop is about two weeks old the plants in the chop should be "thinned out" leaving only TWO plants in each chop. Manuring should be done with sulphate of ammonia at the rate of 2cwt per acre, six weeks after planting. The cotton crop should be planted in the month of July, and the wind-break, earlier.

9. HARVESTING OF CROPS. Except for Lisbon Yams and Sweet Potatoes the harvesting dates of which are controlled in paragraphs 1 and 4 above, all crops must be reaped when matured and fit for consumption, or otherwise as the Competent Authority may from time to time direct.

APPENDIX IV

BIBLIOGRAPHY ON FOOD CROPS IN BARBADOS

YAMS		JOURNAL OR AUTHOR	TITLE
1.	1908-9	Department of Agriculture	Shipments of sweet potatoes and Yams. Ann. Rep. 1908-9, p.13.
2.	1911-12	"	Yam cultivation.
	1912-13	"	Ann. Report, 1911-12, pp.40-41.
	1913-14	"	" " 1912-13, p.27.
	1914-15	"	" " 1913-14, p.28.
	1915-16	"	" " 1914-15, pp.31-32.
	1916-17	"	" " 1915-16, p.28.
	1917-18	"	" " 1916-17, pp.28-29.
	1919-20	"	" " 1917-18, p.25.
	1922-23	"	" " 1919-20, pp.5-6.
			" " 1922-23, pp.4-5.

YAMS Cont'd.		JOURNAL OR AUTHOR	TITLE
3.	1919	D.S.A.	An experiment in yam cultivation. Agriculture News, pp.28, 40.

SWEET POTATOES

1.	1901	Imp. Department of Agriculture	Recent experiments with sweet potatoes. W.I. Bull. Vol. 2, pp.293-297.
2.	1902	"	Manuring and storing of sweet potatoes. W.I. Bull. Vol. 3, pp.206-211.
3.	1902	"	Sweet Potatoes. Agriculture News Vol.1, p.7.
4.	1905	Hall, R.R. & Bovell, J.R.	Experiments with sweet potatoes at Barbados. W.I. Bull. 5, pp.41-52.
5.	1908	Imp. Department of Agriculture	Sweet potatoes Weevil at Barbados. Agriculture News 7, p.345.

SWEET POTATOES Cont'd.		JOURNAL OR AUTHOR	TITLE
6.	1908-9	Department of Agriculture	Ann. Report 1908-9, pp. 7-10.
	1910-11	"	" " 1910-11, pp. 30-34.
	1911-12	"	" " 1911-12, pp. 34-35.
	1912-13	"	" " 1912-13, p. 41.
	1916-17	"	" " 1916-17, p. 29.
	1919-20	"	" " 1919-20, p. 13.
	1928-29	"	" " 1928-29, pp. 41-44.
	1929-30	"	" " 1929-30, pp. 41-48, 113.
7.	1910	Ballou, H. A.	The Scarabee of sweet potato. W.I. Bull. Vol. 10, pp. 180-196.
8.	1912	Robson, W.	The classification of sweet potatoes. W.I. Bull. Vol. 12, pp. 521-529.
9.	1929-30	Department of Science & Agriculture	Cooperative marketing of ground produce and vegetables. Ann. Rept. 1929-30, p. 14.

SWEET POTATOES Cont'd.		JOURNAL OR AUTHOR	TITLE
10.	1931	Department of Science & Agriculture	Sweet potatoes in Barbados, The improvement of. Pamphlet No. 6 (Old Series).
11.	"	D.S.A. (Dept. of Science & Agric.)	Sweet potato defoliators. Pamphlet No. 9 (Old Series).
12.	1932	D.S.A.	Sweet potato experiments. Agric. Journal. Vol. 1, 1932, pp.13-18.
	1933	"	" " Vol. 2, No. 3, pp.27-30.
	1934	"	" " Vol. 3,No. 3, pp.23-25.
	1935	"	" " Vol. 4, 1935, pp.81-82.
	1936	"	" " Vol. 5, 1936, pp.54-55.
	1937	"	" " Vol. 6, 1937, p.65.
	1938	"	" " Vol. 7, 1938, p.49.
13.	1934	McIntosh, A.E.S.	Sweet potatoes - seedling raising and testing. Agric. Journal. Vol. 3, No.2, p.38.

SWEET POTATOES Cont'd.		JOURNAL OR AUTHOR	TITLE
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15.	1942	D. S. A.	Possible means for an efficient use of a large sweet potato crop. Pamphlet No. 10 (New Series).
16.	1955-56	Bolton, J.	Fertilizer cultivation trial on sweet potatoes. Record Investigations, 1955-56, pp. 20-22.
17.	1956-57	"	Sweet Potatoes fertilizer trials. Ann. Report D. S. A., pp. 56-57, p. 28.
18.	1960	"	Storing Sweet potatoes. World Crop, Feb. 1960, p. 73.

CASSAVA, DASHEEN, EDDOES, ETC.		JOURNAL OR AUTHOR	TITLE
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			Ann. Report. 1908-9, pp. 10-13.
	1910-11	"	" " 1910-11, pp. 34-36.
	1911-12	"	" " 1911-12, pp. 36-38.
	1912-13	"	" " 1912-13, pp. 25-26.
	1913-14	"	" " 1913-14, pp. 22-25.
	1914-15	"	" " 1914-15, pp. 28-30.
	1915-16	"	" " 1915-16, pp. 26-27.
	1916-17	"	" " 1916-17, pp. 26-27.
	1917-18	"	" " 1917-18, pp. 22-24.
	1919-20	"	" " 1919-20, pp. 3-5.
	1922-23	"	" " 1922-23, pp. 3-4.
2.	1910	Bancroft, C.K.	Eddoes - Fungus diseases of.
			W.I. Bull. Vol. 10, 1910, p. 236.

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3.	1912-13	Department of Agriculture	The Cassava hawkmoth, Erinnyis (Dilophonota) ello. L.
4.	1938	"	Ann. Report. 1912-13, p. 41. Ground Provisions. Agric. Journal. Vol. 7, pp. 33-34.
5.	1917	"	Supply of ground provisions at Barbados. Agric. News, Vol. 14, p. 137.
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1.	1903	Imp. Department of Agriculture	Barbados Bananas. Agric. News, Vol. II, 1903, pp. 228-229, 292.
2.	1904	"	Bananas, shipment of. Agric. News, Vol. III, pp. 87, 113-114.

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3.	1905	Imp. Department of Agriculture	The Barbados Banana Industry. W.I. Bull. Vol. 5, pp.232-235.
4.	1906	"	Carriage of fruit from Barbados. W.I. Bull. Vol. 5, pp.129-134.
5.	1906	Bovell, J.R.	The fruit industry at Barbados. W.I. Bull. Vol. 6, pp.99-108
6.	1906	Imp. Department of Agriculture	Barbados Bananas Agriculture News, Vol. 5, 1906, p.84.
7.	1913-14	Department of Agriculture	Diseases of the Banana. Ann. Report, 1913-14, p.44.
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5.	1911-12	"	The exportation of fruit and vegetables.
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	1912-13	"	" " 1912-13, pp.28-29.
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	1914-15	"	" " 1914-15, pp.33-34.
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8.	1952	Skeete, C.C.	Plants bearing edible fruits. Garden Book of Barbados, Chapt. 12, pp.136-145.
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