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COMMITTEE ON

**AGRICULTURE, NUTRITION,
FISHERIES AND FORESTRY**

OF THE

CARIBBEAN RESEARCH COUNCIL

**VEGETABLES IN
THE CARIBBEAN**

CROP INQUIRY SERIES No. 5

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The Anglo-American Caribbean Commission was created by the Governments of the United States and the United Kingdom on March 9, 1942, for the purpose of encouraging and strengthening social and economic cooperation between the United States of America and its possessions and bases in the area known geographically and politically as the Caribbean, and the United Kingdom and the British colonies in the same area, and to avoid duplication of research in these fields. On December 20, 1945, the following joint communiqué was issued: "The Governments of France and of the Netherlands have accepted an invitation extended to them by the Governments of the United Kingdom and United States of America to join the Anglo-American Caribbean Commission. The name of the Commission will be changed appropriately . . ." The Commission is now known as the Caribbean Commission.

The Caribbean Research Council was established by the Commission in August, 1943, to survey needs, to determine what research has been done, to facilitate research on a cooperative basis, and to arrange for the prompt dissemination of the results of research, all without limitation to the field of inquiry.

In pursuance of these objectives, a number of Research Committees has been appointed for various fields of research. One of these committees is the Committee on Agriculture, Nutrition, Fisheries and Forestry.

The Committee on Agriculture, Nutrition, Fisheries and Forestry circulated to the agricultural departments and agencies in the Caribbean territories of Great Britain, the Netherlands and the United States a series of crop inquiries covering the various branches of crop and animal husbandry. The Caribbean Research Council hopes to embody the replies to these inquiries in publications to be known as the CROP INQUIRY SERIES. Data for the French territories will be published as supplements to those volumes which were in press before the Government of France joined the Commission. The complete list of inquiries is as follows:

Bananas and Plantains.	Grasses and Grassland
Citrus.	Management.
Cacao.	Land Tenure.
Coconut, Copra and Oil	Livestock.
Seeds.	Root Crops and Legumes.
Coffee.	Rubber.
Cotton.	Spices.
Essential Oils.	Sugar.
Fibers other than Cotton.	Tobacco.
Minor Tropical Edible	Vegetables (exclusive of
Fruits.	Root Crops and Legumes).
Grain Crops.	

INTRODUCTION

Agriculture in the Caribbean has traditionally emphasized production for export. Sugar and other crops have relegated subsistence agriculture and food crops to a subordinate position in Caribbean economy. On the theory that it is more advantageous to produce locally a high-priced export crop and buy low-priced foodstuffs in the world market, the domestic production of foodstuffs has been neglected, or, at best, undertaken only in periods of grave emergency.

The present volume treats of the production of vegetables, exclusive of root crops and legumes, which formed the subject of the preceding volume in the *Crop Inquiry Series*. A companion volume now in preparation, in a series to be known as the *Foreign Trade Bulletins*, will treat these commodities from the standpoint of the import and export trade.

The data presented below for the several territories bear a striking similarity to the data already presented in the volume on root crops and legumes. As was pointed out in that volume, three outstanding facts emerge. The first is the unorganized nature of the production of vegetables. Production is almost exclusively in the hands of peasants, who cultivate the different vegetables, in small kitchen gardens about one-eighth of an acre in size, as a subsidiary part of small scale agriculture in general. Only in rare instances does one read of the cultivation of vegetables on the large units which characterize Caribbean agriculture.

The second fact that emerges from the study of the present volume is the virtual indifference with which the cultivation of vegetables is regarded. In this particular the situation is even more serious than in the case of root crops and legumes, vegetables requiring greater care and skill and being a much more risky investment. Very little seed is produced locally. The seed supply is generally imported. Two complaints will be frequently encountered. On the one hand, cold storage space is either non-existent or inadequate. On the other, importations of seed are often made by drug stores, department

stores, even hardware stores. Sold over the counter to prospective growers, there can be no guarantee of the viability of the seed, and it is not surprising that the percentage of germination is often low. Pests and diseases are common: among the former, aphids, thrips, leaf hoppers, caterpillars, borers, crickets, mole crickets, the diamond-back moth; among the latter, leaf spots, powdery mildew, damping off, mosaic, blossom end rot.

The third fact brought out by the present study is the limited preservation facilities available. Here and there attempts have been made, as in the Bahamas, to can tomatoes; or to make tomato paste or sauce, as in Antigua and Puerto Rico, respectively; or, as in Jamaica, under the stimulus of wartime shortages, to make sauces and pickles. The local canning centers operated by the Agricultural Extension Service of the University of Puerto Rico are, to date, the most important development in this field.

Vegetables, like root crops and legumes, suffer from the basic limitation of Caribbean economy—the monopoly of the best land by other crops, chiefly sugar. Production, in general, is inadequate for the demand, despite the fact that green vegetables have traditionally occupied a far less important place in the Caribbean dietary than carbohydrates, and are consumed by only a small section of the population. The statement made for British Guiana may be taken as representative of all the territories: "In normal years . . . local production of vegetables is unlikely to meet more than a fraction of the requirements, except during unusually favorable seasons." Yet the local demand is likely to increase as the people of the Caribbean come to realize that nutritional deficiencies, revealed by recent medical surveys, can be corrected by consumption of green-leafed and yellow vegetables.

It has been repeatedly emphasized, in the volumes already published in the *Crop Inquiry Series*, that the decision as to the best use of the land, or the allocation of arable land to the various crops, is a political decision, which falls outside the terms of reference of the Caribbean Research Council. The Council's responsibilities are limited to pointing out, in the strongest terms, that the Caribbean territories, in 1947, can no longer afford—if they ever could afford—to neglect

any sector, however small, of their economy. Whatever the ultimate decision as to the respective merits of food and export crops, the present situation is that, without the transfer of one single acre of land from export to food crops, the domestic production of foodstuffs can be increased considerably. In Trinidad, for example, the cultivation of vegetables is described as "rudimentary," tomatoes yield less than one pound of fruit per tree, and, it is added, are often a complete failure. Of the Bahamas it is said that "total yield might be nearly doubled, but much of the crop is wasted." How or why wasted is not explained. That, however, is not important. The Caribbean economy of today cannot afford the luxury of waste.

Nor can it afford haphazard methods or inefficient techniques. The companion volume in this series on the sugar industry gives rightful prominence to Caribbean achievements in sugar research. There is no future for the Caribbean economy if it continues to base the significance of research solely on the importance or price of the crop in the world market. Vegetables require intensive and fundamental research no less than sugar. There is little to record, however, in this all-important field. One reads of "small tests" in one territory, of "a little" research in another, of "casual notes on observed behavior" in a third. Virtually no research work has been done in the crucial fields of storage and preservation. The Government Laboratory in Antigua, where experimental work on canning tomatoes was initiated in 1929, was disbanded in 1936.

Pure research is all very well in its way, but applied research is very much better. The extensive knowledge of pests and diseases acquired in Puerto Rico is still an academic question, as there is no adequate local supply of insecticides and fungicides, while the equipment recommended is invariably too costly for the small producer. Research work at the Imperial College of Tropical Agriculture in Trinidad has proved that the yield of tomatoes is increased by closer plantings and by applications of phosphate and nitrogen. The data presented for Trinidad, however, indicate that the graduate research of the College has not yet penetrated the consciousness or improved the practices and technique of the vegetable farmer. However, the College's Peasant Investigation Com-

mittee and its experimental small holdings, as well as the demonstration plots of the Department of Agriculture in Trinidad, should prove of great value in overcoming the ignorance of market gardeners.

Yet, as was pointed out in the case of root crops and legumes, the situation is far from hopeless, and there are encouraging signs. Local associations for the promotion of vegetable cultivation exist, though they are rare. One of the outstanding examples is the St. Croix Agricultural Association. Extension services have been developed in recent years, the chief activities being sale of seedlings, credit for seeds and fertilizers, demonstration plots and model kitchen gardens. In Trinidad proved varieties of seed of high germinating capacity from reputable firms are now on sale at all the marketing depots of the Department of Agriculture, and 5,408 boxes of seedlings were sold in 1946 at the Department's Station at St. Augustine.

In addition, two very encouraging trends, which are brought out in this study, augur well for the future. The first is the development, in pre-war days, of an export trade in vegetables, to the United States in the case of Puerto Rico, and to Canada in the case of the British territories. Tomatoes were produced for export, admittedly on a scale susceptible of considerable expansion, in the Bahamas, Jamaica, Antigua, Montserrat, St. Kitts and St. Vincent. Puerto Rico shipped cucumbers, tomatoes, peppers, eggplants and squash to the United States. The acreage under vegetable crops cultivated for export increased by one-third between 1929 and 1939. The war disrupted this trade. Its chief deterrent, however, particularly in the case of the British territories, was the inadequacy of cold storage space. Puerto Rico enjoyed the advantages of both large refrigerated units in San Juan and regular refrigerated steamship service to the United States. The provision of cold storage space and regular steamship service, with suitable facilities, is an outstanding need in the cultivation of minor, perishable crops in the Caribbean today. The experience of Montserrat, where large losses were sustained in the exports of carrots, turnips and beets to Trinidad, due to the use of sailing vessels without refrigeration, proves that these facilities must be provided not only for extra-Caribbean but also for intra-Caribbean trade.

The second encouraging fact is the development of cooperatives for the cultivation of vegetables. The St. Croix Agricultural Association is canning tomatoes on a scale which is large, in terms of the population of the Virgin Islands of the United States. In Jamaica a cooperative known as Jamaica Vegetables, Ltd., has been organized for the production of tomatoes. The movement has made the greatest headway in Puerto Rico. There are five cooperatives engaged in the production of vegetables. Originally established for marketing purposes, their activities have been extended to embrace the purchase of equipment, fertilizers, insecticides and containers. The number of members amounts to 857, and the volume of business to \$337,523. The figures are infinitesimal in relation to the general economy of Puerto Rico. But the trend is significant. In its recommendations for the future of local handicrafts in the Caribbean, the Second Session of the West Indian Conference, held in St. Thomas, Virgin Islands of the United States, gave prominence to the development of producers' cooperatives, and recommended to the Caribbean Research Council the study of cooperative movements in the region. It is pertinent to recall that the enduring contribution of the Scandinavian countries in the modern world, the basis of the efficient agriculture and the powerful democracy they have developed, is the cooperative movement.

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BAHAMAS

Varieties

Type	Vegetable	Variety	
(a) Leaf and Stem Vegetables	Cabbage	Early Jersey Wakefield; Early Flat (round) Dutch	
	Broccoli	Italian Green Sprouting	
	Cauliflower	Snowball	
	Collard	Georgia	
	Kohl-Rabi	White Vienna	
	Endive	Green Curled	
	Spinach	Old Dominion	
	Onion	Yellow Bermuda	
	(b) Salad and Fruit Vegetables	Lettuce	Black-Seeded Simpson
		Tomato	Rutgers; Livingston Globe; Marglobe
Okra		Perkins Long Pod	
Pepper		California Wonder; Florida Giant	
Eggplant		Ft. Myers Market; Black Beauty	
(c) Gourds and Pumpkins		Celery	Supreme Golden
		Cucumber	Straight 8
	Muskmelon	Rocky Ford	
	Melon	Honey Dew	
	Squash	White Bush Scallop; Acorn or Table Queen	
	Watermelon	White-Seeded Chilian; Stone Mountain	
(d) Root Vegetables	Beet	Early Blood Turnip; Green Top Bunching; Detroit Dark Red	
	Carrot	Danvers Half Long; Imperator	
	Radish	Scarlet Turnip	
	Turnip	White-Tipped White Egg; Purple Top White Globe	
	(e) Flavoring and Seasoning Herbs	Rutabaga	American Purple Top
Parsley		Paramount	
Mustard		Florida Broad Leaf	

Seed Supply

All seed supplies are imported from the United States.

Organization of Production

Production of vegetables is mainly confined to private gardens. There are a few small scale market gardeners. Tomatoes are the only important export crop. They are produced by a number of growers, ranging from peasant farmers to small scale commercial farmers.

Ecological Considerations

Vegetable and tomato production is mainly confined to the autumn and winter seasons.

There is very little variation in ecological conditions, and they do not influence the different kinds of vegetables cultivated. Soil types are similar throughout the Colony, and they are all highly calcareous.

Diseases and Pests

There are few pests and disease problems, and control measures are seldom undertaken.

Organization of Production for Export

Only tomatoes have attained the status of an agricultural industry.

Seed supply comes from the United States. Tomatoes are produced by both peasants and estates, the total acreage amounting to 1,200 acres. On account of the rocky nature of the soil, manual labor prevails. Virgin coppice land is used, the bush is cut and burned, and the tomatoes planted in the packets of soil among the rocks. The average yield per acre is 150 lugs of 30 lb. each. Total yield could be doubled, but a large part of the crop is wasted. Government regulations prescribe the grading of tomatoes according to size and their inspection before they are exported. Weekly auctions are organized by the Board of Agriculture and held throughout the season. Total exports amount to between 150,000 and 200,000 lugs; all go to Canada. Average prices of exports vary from 6/- to 12/- per lug.

Local Methods of Preservation

Minor quantities of tomatoes are canned in a small local cannery.

Numbers Engaged in Production

2,000 to 3,000 people can be employed during the season in the tomato industry.

Legislation

There are regulations controlling packing, grading and inspection of tomatoes.

Extension Service

Some farmers associations are assisted by the Board of Agriculture by the granting of credit on supplies of seeds and fertilizers.

BARBADOS

Varieties

<i>Type</i>	<i>Vegetable</i>	<i>Variety</i>	
(a) Leaf and Stem Vegetables	Cabbage	Danish Ball 'Head; Late Flat Dutch; Charleston Wakefield	
	Cauliflower	Suttons Early Patna; Early Market (all the year round)	
	Kohl-Rabi		
	Leek	Giant Musselburgh	
	Shallot		
	Spinach		
	(<i>Basella alba</i>)		
	Onion	Crystal Wax (White Bermuda)	
	(b) Salad and Fruit Vegetables	Lettuce	Mignonette
		Tomato	Marglobe
Okra		Local Varieties	
(<i>Hibiscus esculentus</i>)			
Pepper			
Eggplant		Black Beauty; Florida High Bush	
(c) Gourds and Pumpkins		Celery	
	Pumpkin		
	Cucumber	Local Varieties	
	Christophine	Local Varieties	
	(Chayote)		
	Melon		
(d) Root Vegetables	Squash		
	(<i>Cucurbita</i> sp.)		
	Beet	Eclipse; Crimson Globe; Detroit Dark Red	
	Carrot	Chantenay; Oxheart; Danvers Half Long	
	Turnip		
	Jerusalem Artichoke		
	(<i>Helianthus tuberosus</i>)		

Seed Supply

With the exception of cucumber, christophine, shallot, okra, squash and pepper, all vegetable seed is obtained from Canadian and United States seed houses. There are no local commercial seedsmen. The Department of Agriculture is probably the largest importer of vegetable seed, which is kept in cold storage until sold.

Organization of Production

Vegetables are produced almost entirely by small holders, comparatively few of whom depend solely on this means for a living.

The majority of vegetable gardens are considerably less than one acre in size.

Ecological Considerations

All classes of vegetables may be produced throughout the year, but it is recognized that, when irrigation is possible, the best results are obtained in the cooler dry months from December to June.

Diseases and Pests

Diseases and insect pests are at times serious, more particularly during the wet season. The main diseases are:

Beet	}	— <i>Cercospora</i> leaf spot
Carrot		
Cucurbits		—Powdery mildew.

The main insect pests are: aphids, thrips, leaf hoppers and various leaf-eating and pod-boring caterpillars.

Relation of Production to Local Requirements

Production of vegetables does not meet the local requirements, and in the past there have been small importations from the United States of America, Canada and other West Indian Islands.

Prices

Under wartime conditions, prices of locally produced vegetables were as follows, in cents per lb.:

<i>Vegetable</i>	<i>Wholesale</i>	<i>Retail</i>
Beet	10	14
Cabbage	15	20
Carrot	12	16
Cauliflower	18	24
Christophine (Chayote)	6	8
Cucumber	4	6
Shallot—Green	15	20
Shallot—Dry	18	24
Kohl-Rabi	9	12
Pumpkin	3	4
Squash	15	20
Tomato	12	16
Vegetable Marrow	4	6

Research

Small scale testing of new vegetable varieties is carried out by the Department of Agriculture, and advice and information given to growers through a staff of Peasant Agricultural Instructors.

BRITISH GUIANA

<i>Type</i>	Varieties	<i>Variety</i>
(a) Leaf and Stem Vegetables	Cabbage	Early Flat (round) Dutch
	Cauliflower	Early Benares; Early Patna
	Chinese Cabbage	Chihli; Wong Bok
	Swiss Chard	Lucullus
	Kohl-Rabi	Early White Vienna
	Callalu-French (<i>Phytolacca octandra</i>)	
	Callalu-Caterpillar (<i>Amaranthus</i> sp.)	
	Indian Kale (<i>Xanthosma atrovirens</i>)	
	Onion	Yellow Bermuda
	Shallot	Bombay Red; Red Madras; Local White
(b) Salad and Fruit Vegetables	Lettuce	Mignonette; Black-Seeded Simpson
	Tomato	Ponderosa (Brimmer); Mar- globe; Sutton's Early Mar- ket; Local Varieties
	Eggplant	Long Purple (Thornless) Black Beauty
	Okra	Six Weeks
	Celery	Easy Blanching
	Pepper	Red Chili; Chinese Giant
	Cucumber	Arlington White Spine; Local Varieties
(c) Gourds and Pumpkins	Pumpkin	Southern Field
	Squash	Early Prolific Straightneck; Hubbard
	Watermelon	Dixie Queen
	Muskmelon	Honeydew
	Gourd (<i>Lagenaria vulgaris</i>)	
	(d) Root Vegetables	Beet
Carrot		Imperator; Danvers Half Long
Turnip		Purple Top White Globe
Radish		White Icicle; Vick's Scarlet Globe
Jerusalem Artichoke		
(e) Flavoring and Seasoning Herbs	Mint (<i>Mintha viridis</i>)	
	Mustard	Southern Giant Curled; Mus- tard Spinach (Tender- green)
	Parsley	Extra Curled
	Thyme (<i>Thymus vulgaris</i> ; <i>Coleus aromaticus</i>)	
	Coriander (<i>Cori- andrum sativum</i>)	

Seed Supply

Vegetable seed is now imported almost entirely from the United States of America, with the exception of cauliflower seed, which is obtained from Suttons of India. Before the war, however, vegetable seed was frequently obtained from English seedsmen.

The Department of Agriculture imports the bulk of the vegetable seed used in British Guiana. An order is placed with H. G. Hastings Co., Atlanta, Georgia, about the middle of the year, to arrive in British Guiana at the beginning of the following year. This seed is stored in cold storage at a temperature of 40° F., and only the daily requirements are taken out of the store. By this method most seeds will remain viable for at least twelve months. The sale and distribution of this seed are controlled by the Curator of the Botanic Gardens. Residents of Georgetown purchase their requirements of vegetable seed direct from the Botanic Gardens, whilst growers in the outlying districts usually order their seeds through the District Agricultural Officers, who, in turn, obtain their supplies from the Botanic Gardens. Growers are encouraged to purchase only sufficient seed for their immediate sowing, to avoid loss through faulty storage. Many small orders are, therefore, despatched from the Botanic Gardens daily. On an average, between 16,000 and 20,000 packets of vegetable seeds, each weighing one-third of an ounce, are sold by the Department of Agriculture at cost price annually.

Some seed is imported by local firms from the United States of America. But this is not considered an ideal arrangement, in view of the fact that the firms dealing with these seeds are not seedsmen. If the seeds from such establishments as drug stores and hardware stores are sold rapidly, there is a reasonable chance of the purchaser obtaining fairly good results. But the seeds are frequently displayed on the shop counter for a considerable time before being sold. Hence the percentage of germination is often very low.

Annual requirements of vegetable seeds are estimated at 500 lb., which come from the United Kingdom, Canada and the United States. Merchants usually purchase on a sale or return condition. Large quantities are returned.

Imports from 1939 to 1943, c.i.f. value, are as follows, in British West Indian dollars:

<i>Country of Origin</i>	1939	1940	1941	1942	1943
United Kingdom	211	168	27	—	—
British West Indies	60	—	—	—	—
China	46	35	10	—	—
Netherlands	30	39	—	—	—
United States	174	592	746	4558	5705*
Canada	—	597	649	509	565
Hong Kong	—	39	—	—	—
Argentina	—	—	—	22	—
Total	521	1470	1405	5116	6270

Very little vegetable seed is produced locally. Occasionally individual growers will produce sufficient seed for their own requirements of such vegetables as lettuce, tomato, eggplant, cucumber, pumpkin and squash.

Organization of Production

Vegetable market gardens, usually consisting of areas approximately one-eighth of an acre in extent, exist in the neighborhood of the large towns. These are generally cultivated in conjunction with livestock rearing, mainly dairying. In Georgetown and New Amsterdam, many people grow vegetables for home consumption, and, in some cases, areas normally devoted to ornamental gardening are now used for vegetable culture. There is also a small production of vegetables from wartime allotments in these towns. In the country districts small homestead gardens are sometimes planted by East Indians, who are engaged in other agricultural activities.

There is, in a few instances, a tendency on the part of peasant farmers to specialize in a single vegetable crop. For example, fair quantities of tomatoes are produced in one section of the Corentyne Coast and are marketed in Georgetown by speculators, while eschalot is grown and marketed green by farmers in some parts of Western Berbice and Eastern Demerara. Production is extremely seasonal and variable.

Ecological Considerations

Vegetables are cultivated mainly on two types of soil: heavy clay and sand reefs. Most of the cultivations are on clay soils, but the sand reefs are really far more satisfactory for vegetable culture, especially if a good water supply is available. The main objection

* Includes an importation of blackeye peas by the Government valued at \$4541.

to the clay soil is that of drainage. Although the beds are made up, well above the soil level, drainage is very poor, and the plants are often standing in semi-flooded conditions after very heavy rain.

The average annual rainfall is between 90 and 100 inches. Generally speaking, there are two rainy seasons in the year. The rains begin toward the end of April and are heavy until July, are lighter in August, while during the months of September to November there is little or no rainfall. Towards the end of November, rains begin again and continue until January. The period from February to the middle of April is drier, but not as dry as from September to November.

In addition to rainfall requirements, most vegetables show distinct seasonal preferences, and this should not be lost sight of when planting. The best time to sow is in late October or early November, and to plant out, during November, especially in the case of onions, cabbage, tomatoes, cauliflower and kohlrabi. These crops, when grown during the hot dry months of the year, are likely to give disappointing results, and are usually at their best when reaped between February and May. For some of the more hardy crops, a second planting can be made with the April showers, and cultivation continued as weather permits.

Problems of Cultivation

The cultivation of vegetables in British Guiana is attended with considerable difficulty. Although most vegetables can be grown with limited success, the climate and attacks of insect pests and diseases are generally the cause of many failures. The problem of drainage in the clay soils, a difficult one to solve, is also responsible for many disappointments. The amount of effort required to produce vegetables in British Guiana is far greater than that required in other areas in the Caribbean, and the quality and yields are poor compared with many other places.

Diseases and Pests

The chief diseases are:

Damping off: This is caused by one or more fungi in the seed beds. The control is to ensure good drainage in the seed boxes or beds and good ventilation among the seedlings, so that the atmosphere is not too damp. The seed must be sown sparsely,

and beds in the open protected from heavy rains by temporary coverings.

Wilt: This is usually caused locally by attacks of fungi of the genus *Fusarium* commonly found in the soil. Poor soil and bad drainage weaken the plant and favor the attacking fungus. Tomatoes are very susceptible to attack, and should not be grown repeatedly on the same soil.

Molds and Mildew: These diseases on leaves and fruits are usually the result of abnormally wet weather conditions. Proper choice of season for planting is the remedy.

Mosaic: This is another type of disease which may be mentioned here, though, fortunately, it is not very common, except on tomatoes. The remedy is the use of resistant varieties and the immediate removal and destruction by fire of affected plants, as soon as they show symptoms of the disease.

Blossom end rot: This is a very common complaint locally. To prevent the disease, every effort should be made to make the water supply to the plants as regular as possible. Excessive watering is to be avoided. In dry weather the plants should be mulched and shaded from the very hot sun.

The following are the principal species of biting insects which attack vegetables in this Colony:

- (1) the tomato caterpillar (*Protoparce* and *Phytometra*);
- (2) the cabbage butterfly (*Pieris phileta*);
- (3) the green cabbage borer (*Hellula phidilealis*);
- (4) the leaf edge roller (*Psara bipunctalis*) attacks spinach, beet, boulangier, French and caterpillar callalu (barjie);
- (5) the flea beetle (*Epitrix pilosa*) attacks the eggplant;
- (6) the beetle leaf borer (*Lactica* sp.) feeds on okra.

Control measures: In the case of caterpillars hand picking is feasible if the plots are not too large and close observation has been maintained to detect insect attack. Spray or dust with lead arsenate. Do not apply the spray or dust when the caterpillars are full grown and the damage has been done. The reason for this is that many of the poisoned caterpillars contain parasites, and these will perish also; thus, a renewal of the attack will be expedited. A lead arsenate dust may be applied to plants infested with flea beetles.

The commonest of species of sucking insects are plant lice or aphids and lace wing bugs (*Corythuca*); white fly and thrips are much rarer. Spraying with nicotine sulphate is the commonest method of treating these pests.

Crickets and mole crickets cause considerable damage to vegetables, especially in the seedling stage. Apply a poison bait consisting of 5 lb. of bran and $\frac{1}{2}$ lb. of Paris green, mixed with two pints of molasses. Apply immediately after preparation, as the bait is useless once fermentation has begun. The time to apply is in the afternoon. Applications should be repeated until the pest ceases to be noticeable.

Coushi ants (*Atta* sp.) are leaf-cutting, fungi-rearing ants, and are far more dangerous than other ants. They are best controlled by fumigating with carbon bisulphide. The nests are often large, and should be inspected again ten days after treatment for signs of renewed activity, in which case fumigation should be repeated.

The red stinging ant (*Solenopsis*) is another important pest. A search should be made for the nest which should then be flooded out with engine oil or gasolene. An alternative method of treatment is to pour a tablespoon full of carbon bisulphide into a narrow shaft sunk about six inches into the nest, which should then be covered over with damp bags.

The beetle stem borer is a serious pest of the eggplant. The injury caused by the grub consists of a boring of the stem, the adult beetle escaping by gnawing a circular hole. The latter feeds on young shoots and small areas of the bark. The only helpful control measure is to avoid cutting back the plants, as this leaves many beetles to continue the attack in the next season.

Relation of Production to Local Requirements

Apart from pumpkins and squash, which are usually plentiful during the wet season, the production of vegetables in this Colony is inadequate to meet the demand.

Before the war, fresh vegetables were imported from the British West Indies, Bermuda and Canada. The imports included tomatoes, cabbage, lettuce, cauliflower and onions. These imports were reduced during the war, owing to war restrictions.

Research

Small plot trials are conducted at the District Agricultural Stations and the Botanic Gardens on all varieties of vegetables imported into the Colony. This work is financed by the Government.

Vegetable production has not reached the stage where research work on storage and preservation has become necessary.

Extension Service

In order to encourage the production of green vegetables in Georgetown, the Department of Agriculture maintains a demonstration plot of one-eighth of an acre, where all kinds of green vegetables are grown. Demonstrations are also given at the District Experimental Stations on the proper methods of growing vegetables, and supplies of seed and seedlings from these plots are distributed free of charge to school gardens and recognized market gardeners. Further, supplies of vegetable seedlings, viz., lettuce, tomatoes, eggplant, Chinese cabbage, Swiss chard and cabbage, can be obtained from the Botanic Gardens at the price of 3 cents per two dozen seedlings.

Local Associations

The Georgetown Gardeners Club and Allotment Association encourage members to grow more vegetables by arranging suitable lectures on the subject and by visiting gardens of repute in the Georgetown area. District Committees assist by supplying free seed, and, in certain cases, grants towards purchasing fencing materials and tools.

The Government Produce Depot buys pumpkins and squash from producers, and, occasionally, small quantities of other types, such as tomatoes, melons and Jerusalem artichoke. Most of this trade is in the hands of hucksters.

Wartime Developments

The production of vegetables materially increased during the war years as a result of the food production campaign initiated in 1940. However, widespread flooding at the end of 1942 and early in 1943 caused a temporary setback. Production was further stimulated by annual vegetable garden competitions conducted by the Department of Agriculture, the distribution of free seed to school gardens, and the sale of vegetable seed to the public at cost price. The community evinced a wider interest in vegetable gardening than it did before the war. Shortage of farmyard manure, especially in the towns, was the chief difficulty encountered. In normal years, however, local production of vegetables is unlikely to meet more than a fraction of the requirements, except during unusually favorable seasons.

BRITISH HONDURAS

Varieties

<i>Type</i>	<i>Vegetable</i>	<i>Variety</i>
(a) Leaf and Stem Vegetables	Cabbage	Early Jersey Wakefield; Copenhagen Market; Stein's Flat Dutch
	Cauliflower	Early Patna; Early Benares; Early Market
	Onion	Crystal Wax (White Bermuda); Red Bermuda
	Shallot	
(b) Salad and Fruit Vegetables	Tomato	Marglobe; Pritchard (Scarlet Topper); Ponderosa
	Lettuce	Grand Rapids; Mignonette
	Okra	
	Pepper	
(c) Gourds and Pumpkins	Eggplant	
	Cucumber	Chinese Long
	Squash	
	Pumpkin	
(d) Flavoring and Seasoning Herbs	Melon	
	Chive	

Seed Supply

Nearly all the small quantity of seed required is imported by the Department of Agriculture and retailed from its various Stations. One or two of the larger stores in Belize import small amounts of seed. Cabbage seed and tomato seed are imported from the United States; cauliflower seed from the India House of Suttons in England.

To a very small extent some growers keep their own seed.

Organization of Production

There are one or two whole time market gardeners, working on a small scale, who produce vegetables for the Belize market. Otherwise, vegetable growing forms a subsidiary part of small scale agriculture.

Ecological Considerations

Vegetables are abundant only during the cooler winter months from November to March. At other times they are scarce. It is interesting to note that onions are mostly grown in the drier, northern part of the Colony, where the average rainfall is only about 60 inches per annum. Shallot and chive are grown in all districts.

Diseases and Pests

The most serious pest is the Parasol ant (*Atta* sp.), locally known as the "Wee-wee" ant. This attacks and defoliates all kinds of vegetable crops. The most effective way of dealing with it is to pump Cyanogas into the nests. This treatment, however, is comparatively expensive.

Wilt, both bacterial and nematode, of tomato and eggplant is fairly common.

Relation of Production to Local Requirements

The supply of vegetables is adequate, indeed plentiful, during the winter months, November to February or March, but inadequate during the remainder of the year.

Research

Vegetable production has formed a part of the activities of the Agricultural Stations of the Department of Agriculture for some years past. The possibilities of growing the chief kinds of vegetables in each district have been explored, and this work has, undoubtedly, led, in a small way, to the spread of vegetable growing in the Colony.

Marketing

The purchase of fresh vegetables by the Board of Agriculture has not been successful in the past, partly owing to lack of storage facilities.

Wartime Developments

The wartime "grow more food" drive led to some increase of vegetable cultivation.

CURACAO

Varieties

<i>Type</i>	<i>Vegetable</i>	<i>Variety</i>	
(a) Leaf and Stem Vegetables	Cabbage	Early Jersey Wakefield	
	Chinese Cabbage	Chihli	
	Swiss Chard	Fordhook Giant; Lucullus	
	Onion	Española (White Sweet Spanish)	
	Kohl-Rabi	White Vienna	
(b) Salad and Fruit Vegetables	Endive	American Flag	
	Leek	Black-Seeded Simpson	
	Lettuce	Winsall	
	Tomato	Black Beauty	
	Eggplant	Golden Plume	
(c) Gourds and Pumpkins	Celery	California Wonder;	
	Pepper	Hungarian Yellow Wax	
	Cucumber	Henderson	
	(d) Root Vegetables	Beer	Crosby's Egyptian
		Carrot	Tendersweet
Turnip		Purple Top White Globe	
Radish		Vick's Scarlet Globe	
(e) Flavoring and Seasoning Herbs	Parsley	Extra Curled Dwarf (Emerald)	

Seed Supply

Seed is imported in small quantities from the United States.

Organization of Production

Vegetables are produced only in wholetime market gardens.

Ecological Considerations

The soil type in Curaçao is a clayish loam derived from the igneous rock diabase. The ecological conditions are not very favorable—high temperature, strong winds and lack of sufficient rainfall (nearly all in the months of November, December and January). For the rest of the year, cultivation depends on irrigation through wells. The water so obtained is often saline.

Problems of Cultivation

The main problem is the supply of sufficient water of good quality, especially in the dry season of the year. For this reason, plantings are restricted in size and number.

Diseases and Pests

Pests and diseases are not numerous. Cutworms, red spider and beetles sometimes cause damage, but they are readily controlled by spraying with commercial garden spray. Red arrow garden spray and Evergreen, obtained from the United States, are the chief sprays used.

Relation of Production to Local Requirements

Production is inadequate. A considerable quantity of vegetables is imported from the United States and other places. In addition, some are brought fresh, by schooners from Venezuela and other surrounding countries.

Numbers Engaged in Production

Vegetable production is on a small scale and cannot be considered an agricultural industry of any importance.

Extension Service

The Department of Agriculture is studying the possibilities of extension service.

Wartime Developments

During the war years, a few patches of suitable land were brought into cultivation by some of the Chinese inhabitants.

RESEARCH WORK AT THE IMPERIAL COLLEGE OF TROPICAL AGRICULTURE

I. TOMATOES

Cultivation

(a) *Spacing*

Paul (5), in 1933-1934, carried out a comparative trial of three spacings—3 x 3 feet, 3 x 2 feet and 3 x 1½ feet. Results indicated that there was a progressive increase in yield with closer plantings. He suggested that further close spacing should be tested, e.g., 3 x 1½ feet, 3 x 1¼ feet and 3 x 1 feet. He pointed out that the advantages of closer spacing, apart from the increase in the number of plants and, consequently, in yield per acre at the optimum, were the mutual protection of the plants from wind and an increase in the shading of the plants from the sun. Closer spacing resulted in increased cost of production per acre. With closer spacing more stakes per acre were necessary; but the increase in yield due to closer spacing, which increased the value of the crop per acre, calculated at 4 cents per lb., more than compensated for the increased cost of staking.

(b) *Staking*

Wight (2), in 1932-1933, found no significant difference between the total yield of fruit from staked and unstaked plants, using a spacing of 2 x 4 feet. Unstaked plants gave a significant increase over staked in the yield of good fruit. Disease was 6 per cent lower on the staked plots, and mis-shapen fruit (mainly cracked) was 14 per cent lower on the unstaked plots. Ashby (3), in 1933-1934, found that staking gave a 50 per cent higher yield of cracked fruit but a high yield of exportable fruit. Staking, however, did not prove an economic means of increasing the yield of good fruit in a dry season. He pointed out that the experiment was carried out in a really dry season, and, had much rain fallen, the unstaked plots would have suffered more severely and the balance possibly turned in favor of staking. He found that harvesting could be done more rapidly and with less damage to plants in staked plots. Miller (4) found that staking was effective in increasing the total yield and also the yield of large, good fruit, but the total profit was greater on the unstaked plots. This was due to the great expense involved in providing and erecting bamboo stakes.

(c) *Manuring*

Ashby (3), in 1933-1934, obtained the highest yield from NPK plots, the decrease in yield due to lack of N, P, or K being 22.8 per cent, 23.3 per cent and 14.3 per cent, respectively. He found that manures had no effect on the proportions of the grades of fruit obtained, but caused a greater total weight of fruit to be produced. He further found that soil tilth might be a more serious limiting factor than manurial constituents, and that the early application of a heavy dressing of organic manure might be beneficial. Miller (4), in 1933-1934, found that phosphate in all respects was the manurial constituent most beneficial in the production of tomatoes. Nitrogen was almost as important, and gave the highest return per unit of expenditure. Potash was the least important of all, the return from potash manuring being just sufficient to cover the cost of the manure itself. It was shown to be more important than either of the other two manures only in reducing the proportion of diseased fruit. However, the total amount of such fruit was never high, and this beneficial effect was, thus, of little account. The effects of phosphate and nitrogen were specially marked in increasing the proportion of large fruit.

In 1934-1935, however, McCreary (6) obtained no significant difference between yields from the different treatments. Potash gave the greatest response, and showed a tendency to produce a slightly greater proportion of large fruit. Nitrogen seemed to encourage the production of smaller fruit. As was noted previously by Miller (4), McCreary also found that potash reduced the incidence of cracking and disease.

(d) *Varieties*

Mason (1), in 1932, studied 6 hybrids obtained from the Central Experimental Farm, Ottawa, with a view of ascertaining the types most suited to local conditions. Variety C contributed the heaviest crop of graded fruit; A had the most desirable shaped fruit of all varieties, and Mason thought that the variety would prove to be more economical commercially. He recommended that this type should not be omitted in further investigations. Paul (5), in 1934, carried out a comparative trial, mainly from the yield standpoint, of three varieties. The varieties were Marglobe, Red Rock and Bonny Best. There was no significant difference between the yield of the varieties. Marglobe showed the least tendency to vary in uni-

formity of shape. He found that Red Rock was a late bearer in comparison with the other two varieties. He concluded that since Marglobe was not an inferior yielding variety in comparison with Red Rock and Bonny Best, it was, in his opinion, the most suitable variety for growing in the West Indies in view of:

- (a) the preference shown for it in the Canadian market for slicing purposes;
- (b) its tendency to greater uniformity in shape and size of fruit;
- (c) its comparative earliness.

Cold Storage Test

Wight (2), in 1932-1933, used selected fruit at the mature, green stage and kept them in the cold storage chamber at 47.5° F. for 17 days. The fruit were then removed to a room at 70° F. and kept there for two weeks. After this time many were still unripe, due to the fact that they were picked before the mature green stage. Loss by disease was greatly in excess of the 1 per cent wastage allowance. *Phoma destructiva* was the main factor responsible for this loss, causing black spots where any slight crack or damage area occurred. Wight found that Trinidad tomatoes did not undergo rapid breakdown on removal from cold storage. However, he concluded that, owing to cracking and disease and to the excessive wastage of fruit in cold storage, it did not seem likely that Trinidad would be a contender for a place in the Canadian market. Paul (5), in 1933-1934, carried out a cold storage trial on one sample of fruit from each of the varieties, Marglobe, Red Rock and Bonny Best, the fruit being taken during the fifth picking. There were no obvious differences between the varieties.

Reference should also be made to the work of Topper (9).

II. CAULIFLOWER

Cultivation

(a) Sowing

Anderson (7), in 1937-1938, concluded that sowing should always be done thinly. In boxes, rows should not be less than 3 inches apart, and in seed beds not less than 6 inches apart. A heavy shade was undesirable; best results were obtained by shading lightly during the heat of the day until the primary leaves had expanded complete-

ly. Pricking-off should not be carried out too soon in the wet season, or damage by heavy rain might occur. He recommended that sowing of seed should be restricted to the latter end of the wet season, when seedlings have a much better chance of survival.

(b) *Planting and Spacing*

Three spacings were employed—2 x 1¼ feet, 2 x 2 feet and 2 x 2½ feet. Anderson found that the widest spacing produced the largest heads due to less competition, which allowed the plants to mature slowly. The closer spacing produced more plants, but with smaller heads. He recommended that, as no regular market for cauliflower in bulk existed in Trinidad, the close planting would be more suited to the general conditions. He pointed out that cauliflower was essentially a dry season crop in Trinidad; during the wet season heavy rainfall and insect attack proved serious handicaps to the seedlings.

(c) *Varieties*

Anderson found that the heads of Early Patna were slightly heavier on the average than the Early Market, but there was really not much to choose between them, the figures being 15.3 oz. and 13.9 oz., average weights, respectively. However, Early Patna had a certain disadvantage which was very obvious during the wet season; water was very liable to collect on the head between the leaves, predisposing it to an unpleasant form of brown rot. The more open nature of the Early Market head did not render it so liable to this disease, although several cases were observed.

(d) *Yield*

The average yield per head at the different spacings were: 2 x 1¼ feet—13.5 oz.; 2 x 2 feet—14.7 oz.; 2 x 2½ feet—15.8 oz. The total yield obtained from the experimental area (0.4 acres) was 1,385 heads weighing 1,263 lb., equivalent to 3,157 lb. per acre.

Reference should also be made to the work of Wood and James (8).

REFERENCES

1. Mason, W. B., *A study of the quality and yields of some tomato hybrids*, 1932.
2. Wight, N. M., *Field and storage experiments on tomatoes*, 1932-1933.
3. Ashby, H. K., *The assessment of the nutrient content of tropical soils by the Mitscherlich method*, 1934.
Report on tomato manurial and cultural experiments.
4. Millet, J. R., *An investigation into the relative effects of different manures and cultural treatments on the production of tomatoes*, 1934.
5. Paul, W. R. C., *A varietal and spacing trial of tomatoes*, 1933-1934.
6. McCreary, G. W. R., *Report on a tomato manurial experiment*, 1934-1935.
7. Anderson, G. W., *Investigations into cauliflower growing in the tropics*, 1937-1938.
8. Wood, R. C. and James, H. M., "Cauliflower cultivation in the tropics," *Tropical Agriculture*, Vol. 13, No. 8, pp. 218-220, August 1936.
9. Topper, B. F., "Tomato cultivation on the College Farm," *Tropical Agriculture*, Vol. 19, No. 9, pp. 180-182, September 1942.

JAMAICA

Varieties

<i>Type</i>	<i>Vegetable</i>	<i>Variety</i>
(a) Leaf and Stem Vegetables	Cabbage	Copenhagen Market; Jersey Wakefield; Charleston Wakefield; Stein's Flat Dutch; Danish Ball Head
	Cauliflower	
	Onion	Crystal Wax (White Bermuda)
	Indian Kale	
(b) Salad and Fruit Vegetables	Celery	
	Lettuce	Mignonette; Simpson's Curled
	Tomato	Oxheart; Ponderosa; Marglobe; Bonny Best
	Sweet Pepper	
(c) Gourds and Pumpkins	Okra	
	Eggplant	
	Cucumber	
	Melon	
(d) Root Vegetables	Pumpkin	
	Squash	
	Beet	
	Carrot	
(e) Flavoring and Seasoning Herbs	Turnip	
	Mint	
	Parsley	
	Thyme	
	Scallion	

Among the varieties of cabbage, Flat Dutch and Ball Head are grown mostly at higher elevations. Cauliflower is grown only to a limited extent. Onion is cultivated on an experimental basis in certain areas. It has done well on the dry plains of St. Elizabeth, where it has developed into a local agricultural industry. Celery is grown on an experimental basis. A few large farmers in the Western Division grow it successfully for domestic use. It has distinct possibilities as a market garden crop. The Mignonette variety of lettuce is especially popular at higher elevations. Indian kale, sweet pepper, okra and eggplant are cultivated only on a small scale. Cucumber, melon, pumpkin squash are chiefly grown on plains with low to medium rainfall. Beet, carrot and turnip are grown at all elevations, but best results are obtained from the higher elevations. Mint, parsley, thyme and scallion are grown on a small scale, at elevations over 2,500 feet.

Seed Supply

The bulk of the seed is imported from the United States by the Jamaica Agricultural Society and distributed through its various depots. Some seed is also imported by private firms and individuals.

The local production of vegetable seed has recently been receiving the consideration of the Department of Science and Agriculture.

Commercial Nurserymen

A few nurserymen in Kingston supply plants on a limited scale. There are no properly organized establishments.

Organization of Production

Production is carried on in kitchen gardens and as a subsidiary part of small scale agriculture, large farmers growing only sufficient for domestic use.

Ecological Considerations

Ecological considerations which encourage development are: light soil types; low medium rainfall; choice of elevation for different seasons of production; availability of manure and mulch.

Diseases and Pests

(i) Diseases

(a) Leaf and Stem Vegetables

Cabbage (*Brassica oleracea* L. var. *capitata* L.) suffers from black rot (*Xanthomonas campestris* (Pamm.) Dawson), which causes a certain amount of loss on wet soils and in rainy weather. But the disease is not very serious. Destruction of plant debris, rotation, seed sterilization and attention to drainage are the recommended preventive measures. Downy mildew (*Peronospora parasitica* (Fr.) Tul.) causes damping off in seed beds, especially at higher altitudes. Protection of seedlings and spraying with Bordeaux are recommended. Mosaic and leaf spots (*Cercospora brassicicola* P. Henn, *Mycosphaerella brassicicola* (Duby) Oudem., and *Alternaria brassica* (Berk.) Sacc.) have been recorded, but none are serious or call for control measures.

Cauliflower (*B. oleracea* L., var. *botrytis* L.) is affected by some of the diseases found on cabbage.

Chinese cabbage (*Brassica chinensis*) is affected by a leaf spot due to *Alternaria oleracea* Milbrath.

Indian Kale (*Xanthosoma sagittifolium* (L.) Schott.) is commonly affected by a leaf blotch, due to a species of *Phyllosticta*, on mature leaves in dry weather.

(b) *Salad and Fruit Vegetables*

Celery (*Apium graveolens* L.) is affected by early blight (*Cercospora apii* Fr.), to control which growers spray with Bordeaux mixture (or Perenox). This crop also occasionally exhibits the non-parasitic diseases known as black heart and cracked stem.

Lettuce (*Lactuca sativa* L.) is occasionally affected by leaf spot (*Cercospora longissima* Trav.), ring spot (*Marssonina panattoniana* (Berl.) Magn.), and mosaic, but none of these is serious.

Tomatoes (*Lycopersicon esculentum* Mill.) are attacked principally by leaf mold (*Cladosporium fulvum* Cooke), which is controlled by spraying; blossom end rot, controlled by mulch, light shade and careful application of water; and root knot (*Heterodera marioni*). The latter is sometimes prevalent without seriously affecting the plants until the crop is nearly over; it is countered by use of rotations. Mosaic in one form or another is common, but not serious. Early blight (*Alternaria solani* (Ell. & Martin) Sorauer), damping off (*Corticium solani*), wilt (*Fusarium bulbigenum* Cooke & Massee var. *lycopersici* (Brushi) Wollenw.), and also *Xanthomonas solanacearum* (E.F.Sm) Dowson, and blight, (*Phytophthora infestans* (Mont.) de Bary) have all been recorded on the crop, but do little or no extensive damage. There has been one doubtful record of *Phoma destructiva* Plowr. causing fruit rot.

Sweet peppers (*Capsicum annum* L.) are affected by leaf spot (*Cercospora capsici* Heald & Wolf), anthracnose (*Collectotrichum nigrum* Ell. & Halst.)—which is troublesome on fruit for shipment, and best countered by careful crop sanitation—, and mosaic, which is more troublesome at low altitudes than high.

Okra (*Hibiscus esculentus* L.) is affected by a number of leaf spots on the maturing leaves, the commonest of which are *Cercospora hibiscus* Tracy & Earle and *C. malayensis* Stev. & Solheim. It also suffers occasionally from root knot (*Heterodera marioni*).

Eggplant (*Solanum melongena* L.) is often affected by blight (*Phomopsis vexans* (Sacc. & Syd.) Harter), which damages the fruit in addition to attacking the leaves, especially in wet weather. It is best countered by rotation and attention to plant sanitation. A fruit rot of fruit for shipment due to *Rhizopus? stolonifer* (Fr.) Lind, has also been recorded, and the crop is subject to attack by root knot (*Heterodera marioni*).

(c) Gourds and Pumpkins

A number of diseases has been occasionally reported on *Cucurbitaceae*. The commonest are downy mildew (*Pseudoperonospora cubensis* (Berk & Curt.) Rostovzev), powdery mildew (*Erysiphe cichoracearum* DC.—[*Oidium* stage]), and root knot (*Heterodera marioni*). None of these is of any importance.

(d) Root Vegetables

There is one record of leaf spot (*Cercospora beticola* Sacc.) on beet (*Beta vulgaris* L.).

Carrots (*Daucus carota* L.) are commonly affected by leaf blight (*Macrosporium carotae* Ell. & Langlois). Spraying is seldom economic. The disease may sometimes be countered by cutting back the diseased leaves and letting new ones replace them. Plant sanitation and crop rotation are also necessary. This crop has also occasionally been reported as affected by root rot, due to *Sclerotium rolfsii* Sacc.

No diseases of Jerusalem artichoke have been recorded.

Turnips (*Brassica rapa* L.) are commonly affected by leaf spot (*Colletotrichum bigginsianum* Sacc.) on mature leaves. They are also occasionally attacked by white blister (*Cystopus candidus* (Pers. ex Chev.) Lev.) in wet weather, and by soft rot (*Erwinia carotovora* (L. R. Jones) Holland). Mosaic, too, is fairly common, but none of these diseases is serious.

(e) Flavoring and Seasoning Herbs

A rust caused by *Puccinia menthae* Pers. has been recorded on mint (*Mentha* sp.).

(ii) Pests

Vegetable	Pests	Control Measures
Cabbage	Eelworms (<i>Heterodera marioni</i>)	Rotation of crops with plants which are not attractive to the pest.
	Aphids (<i>Aphis gossypii</i> and <i>Myzus persicae</i>)	Spray with whale oil soap, 1 lb. to 6 gallons of water.
	Ants (<i>Solenopsis geminata</i>) in seed beds	1 per cent of Jeyes Kerosene Emulsion.
	Cutworms (<i>Lycophotia infecta</i> , <i>Xylomiges sunia</i> , <i>Prodenia ornithogalli</i>)	Bait with a mixture of bran, Paris green and molasses.
	Caterpillars (<i>Pontia monuste</i> , <i>Plutella cruciferarum</i>) which eat the leaves	Spray young plants with lead arsenate, and plants which begin to head with fish oil cryolite.
Lettuce	Ants (<i>Solenopsis geminata</i>) in seed beds	Treatment of soil with Jeyes Kerosene Emulsion. Destroy the seedlings whilst still very young.
	Cutworms (<i>Xylomiges sunia</i>)	Use of Chestnut mixture and, for older seedlings, poison baits.
	White grubs (<i>Ligyris tumulosus</i>)	Handpicking of grubs. Pretreatment of soil with 1 per cent Jeyes Kerosene Emulsion.
		Applications of poison baits.
Tomato	Cutworms (<i>Lycophotia infecta</i> , <i>Prodenia ornithogalli</i> , <i>Xylomiges sunia</i>)	Applications of poison baits.
	Hornworms (<i>Protaparce sexta jamaicensis</i>)	When not usually kept under control by handpicking, spraying with lead arsenate. Natural enemies.
	Ants (<i>Solenopsis geminata</i>) in seed beds	Jeyes Kerosene Emulsion. Field sanitation.
	Fruit worms (<i>Heliothis obsoleta</i>)	Trap plants. Bordeaux mixture (deterrent).
	The Pentatomid <i>Nezra viridula</i>	Destruction of the batches of young by spraying.
Cucumber Melon Pumpkin	Caterpillars (<i>Margaronia hyalinata</i> , <i>Margaronia hirsidialis</i>)	Remove and destroy the leaves which are heavily infested, and dust foliage with lead arsenate.
	Cucumber beetle (<i>Diabrotica themei</i>)	Spray with lead arsenate. Dust with air slaked lime and sulphur, 1 : 5.

Problems of Cultivation

(a) Fluctuating prices, dictated solely by supply immediately available.

(b) Inadequate storage, preservation and processing facilities.

Relation of Production to Local Requirements

The production of vegetables generally is inadequate to meet local requirements during the greater part of the year. Occasionally there is seasonal adequacy and even a surplus of some vegetables, particularly in Kingston. Any surplus of cabbages and tomatoes which may arise from time to time is handled by the Department of Commerce and Industries, the cabbages being kept in cold storage until required by the local market, and the tomatoes exported.

Cabbages, carrots, lettuce, celery and Brussels sprouts were imported from the United States before the war.

Organization of Production for Export

Tomato is the only vegetable grown for export on a large scale. It is produced principally in the parish of St. Elizabeth by Jamaica Vegetables, Ltd., which is managed by Jamaica Welfare, Ltd.

Local Methods of Preservation

Home and factory preservation of vegetables has been carried out on a small scale since the war in the form of sauces and pickles. No statistics are available.

Legislation

(a) Cap. 339, *Laws of Jamaica*, The Agricultural Produce Law. This requires all traders in agricultural produce to take out a license for each of their premises (to which premises their trading is restricted) and a traveler's license enabling them to purchase produce listed in the First Schedule on the grower's premises or by letter or telegram. It prescribes for the application for and granting of such licenses and defines the classes of license, covering various forms of produce, and prohibits the purchase of uncured produce unless provision is made for the curing of the same (and of citrus unless it can be suitably handled).

It requires the keeping of Produce Books, to be open to inspection by authorized persons for detection of offences. It prescribes for the sale and purchase of agricultural produce by a licensed produce dealer and for the form and granting of licenses to be obtained therefor. It requires that the forms of agricultural produce listed in classes 2 and 3 of the First Schedule be accompanied by a certificate of ownership when in transit according to the Schedule, and

that it be used as prescribed. It requires records of contracts made by dealers and exporters concerning specially protected produce, i.e., produce listed in class 2 of the First Schedule, to be deposited with the Deputy Keeper of Records (but banana contracts are dealt with according to Cap. 305, the Banana Industry Regulation Law).

It requires every carrier to be licensed in the manner prescribed; this covers the vehicles used, and only permits the conveyance of specially protected produce in such vehicles. It requires books to be kept in such vehicles recording the produce carried therein, which books are to be open to inspection by authorized persons. It requires unlicensed persons to account for any specially protected produce which may be in their possession. It gives the Governor in Privy Council power to alter the articles of produce classified under the Schedules of this law, to prescribe that produce listed in the Sixth and Seventh Schedules, excepting bananas, may only be exported under registered trade mark, with provisos as prescribed, and to make and alter regulations for the effective exercise of this law in general. It gives the Governor power to appoint Inspectors of Agricultural Produce and places for inspection, grading, etc., and to appoint an Advisory Board. It defines the powers of Inspectors of Agricultural Produce and lists acts that will be deemed offences under this law.

Regulations under this law governing the exportation of vegetables and fruit, September 14, 1937, amended March 11, 1940, are as follows:

They schedule certain fruits and vegetables which may only be exported if packed in a Marketing Department packing house, or one authorized by them, and in quantities to be regulated by the Marketing and Trade Commissioner. Such produce shall only be collected and packed in a manner approved by the Marketing and Trade Commissioner and shall only be exported if of a standard size and quality considered suitable by an Inspector of Produce. The Regulations do not apply to *bona fide* ships' stores or small consignments shipped privately and not for sale.

Schedule

Avocado, pears, beet, carrots, eggplant, fresh beans and peas, granadillas, mangoes, melons of all kinds, passion fruit, peppers of all kinds, pineapples, potatoes of all kinds, radishes, squash, cucumbers, vegetable marrows, tomatoes, tree tomatoes, turnips.

(b) Law 34 of 1939, The Customs Law.

Section 38 empowers the Governor to prohibit by Proclamation the importation of goods either absolutely, or in compliance with such conditions as he may prescribe, and to revoke such prohibition.

A Proclamation under this law prohibiting the importation of fruit and vegetables, January 13, 1934, amended by a Proclamation of January 22, 1935, is as follows:

The importation of fruit and vegetables, except dried fruit and vegetables, seeds, potatoes and onions, is prohibited from all countries except the United Kingdom and Ireland, Canada, the Bahamas, United States of America and New Zealand, whence, however, such imports must be accompanied by a certificate of freedom from pests and diseases, and a certificate that the Mediterranean fruit fly does not exist in the country of origin. Importers of such produce must give seven days notice of its arrival, the produce shall be subject to inspection, and, if infected with pest or disease, may be treated to destroy such, or be destroyed.

(c) Under the Jamaica Defence Regulations, 1940, The Foodstuffs (Production) Order, 1942, and the Foodstuffs (Production) Order (No. 2), 1942, provided that every proprietor (occupier as owner or lessee of lands of an aggregate acreage of one hundred or more) should devote to food crops (including vegetables) not less than two per cent of his available acreage; also, that such crops should be guaranteed and should be purchased by the Marketing and Trade Commissioner (now Commissioner of Commerce and Industries), if not otherwise disposed of by the growers.

Extension Service

The Jamaica Agricultural Society carries out extension work through its Instructors.

Wartime Developments

As a result of propaganda under the Food Production Campaign, which was instituted as a war emergency measure, the cultivation of vegetables increased considerably.

LEEWARD ISLANDS ANTIGUA

Varieties

<i>Type</i>	<i>Vegetable</i>	<i>Variety</i>
(a) Leaf and Stem Vegetables	Cabbage	Premium Late Flat Dutch
	Cauliflower	Early Patna
	Onion	Yellow Bermuda; Crystal Wax (White Bermuda)
(b) Salad and Fruit Vegetables	Shallot	
	Kohl-Rabi	White Vienna
	Lettuce	Mignonette
	Tomato	Marglobe
	Pepper	California Wonder; Local Varieties
(c) Gourds and Pumpkins	Okra	Local Varieties
	Eggplant	Black Beauty
	Pumpkin	Local Varieties
	Melon	
	Muskmelon	
	Watermelon	
(d) Root Vegetables	Squash	Local Varieties
	Cucumber	Local Varieties
	Beet	Improved Early Blood Turnip
	Carrot	Chantenay
	Turnip	Purple Top White Globe
	Jerusalem	
	Artichoke	
(e) Flavoring and Seasoning Herbs	Mint	
	Parsley	
	Thyme	
	Chive	
	Sweet Marjoram	

Seed Supply

The preferred varieties of cabbage, lettuce, tomato, sweet pepper, eggplant, beet, carrot, turnip and kohlrabi are generally imported from seedsmen in the United States, usually Burpees or Peter Henderson. Sometimes vegetable seed is imported from Suttons of Reading, England.

Onion seed is imported from Teneriffe; under wartime conditions, deliveries were irregular and greatly delayed. Seed ordered in 1943 had not arrived in December, 1944. Trials were made with onion seed from other sources, but results were not satisfactory.

Early Patna cauliflower seed is obtained from Suttons of Calcutta through their Antigua agent.

Even in peacetime most of the vegetable seed imported into An-

tigua is imported and sold by the Agricultural Department. Frequent importations are made, and the problem of local storage hardly arises, except in the case of onion seed which arrives in one annual shipment about September. In wartime, importation of seeds was confined almost entirely to the Agricultural Department. Shipments were few, and arrangements were made for storage in sealed tins over quicklime in cold storage.

Locally produced seed is almost entirely home grown. There are no local commercial seedsmen, and no arrangements for storage and distribution.

Local Commercial Nurserymen

There are no local commercial nurserymen. The Agricultural Department grows for sale small quantities of seedlings of tomatoes and onions and, occasionally, of cauliflower.

Organization of Production

There are no whole time market gardens, but there are a few persons engaged in non-agricultural work who grow market garden crops for sale, and grow no other crops. Most vegetable production is a subsidiary part of other agricultural operations, generally of small scale agriculture. In recent years, as a result of wartime conditions, some estates started large scale market gardens. But a rapid increase in the cost of labor, together with the decisions of the Government to control the price of all locally grown produce, made the venture unattractive, and little expansion took place.

Ecological Considerations

The main soil types in Antigua have been determined by C. F. Charter. They are:

(1) calcareous clays with marl sub-soils of good natural drainage:

(a) Wetherell clay (hillside soils with shallow top soil);

(b) Fitches clay (deep top soil);

(2) clays of poor natural drainage;

(a) Gunthorpe, Lindsey and Tomlinson clays—the two former always bounded on one side by Fitches clays and presenting many transitional stages;

(b) Otto clay;

(c) Bendal clay (river valley soil);

- (3) sandy loams of good natural drainage: Blubber Valley & Bental sandy loams.

The average rainfall of Antigua is approximately 44 inches per annum, but the annual variation is great. The extremes recorded are 73.59 inches in 1889 and 25.51 inches in 1930. Monthly distribution is irregular. Normally, May-November is reasonably wet and February-April dry, but any month may be wet and any month dry.

The coastal region of the Island is drier than the interior, the wettest area being the south central district. As the Island is small—108 square miles—the range is not great, varying from 35-50 inches per annum.

As a rule vegetable crops succeed best in the lighter soils of the wetter hilly district and on the deeper and more fertile Fitches clays.

The growth of most of the vegetable crops is determined primarily by adequate rainfall, as there are no facilities for irrigation other than for watering gardens on a small scale during those less severe periods of drought, when pipe-borne water is still available in the City of St. John's.

In addition, most vegetable crops do best during the cooler months, and some fail entirely except at this time.

The cool weather starts about the end of November or in December, and generally coincides with the end of the rainy season, so that vegetable crops are often planted in October-November, and produce is plentiful until about April.

The vegetable crops which do not usually succeed except at this time are onions, tomatoes and cauliflower. These crops, when planted even in wet weather during the hot season, make good vegetative growth, but do not bulb, fruit or head well.

Diseases and Pests

Tomatoes are attacked by various caterpillars which eat the leaves and bore into the fruit. These are effectively controlled by spraying with lead arsenate.

The green stink bug (*Nezara viridula*), other pentatomid bugs, and coreid bugs suck the juices of the fruit, which then never ripen properly. These insects are very serious pests, and no satisfactory method of control is known. Some measure of control is attempted by hand picking or by flicking the insects into kerosene oil in a small bucket, but this is very expensive and is unsatisfactory.

Tomatoes fail to set fruit during the hot season, and there is

some reason to believe that this may be due, to some extent, to attacks by a contarinia on the young flowers.

Beet is attacked by the beet web-worm, and cabbage by the caterpillar of the diamond-back moth (*Plutella maculipennis*). Spraying with lead arsenate has not proved effective.

Onions at times are badly attacked by thrips. Occasionally this pest is treated with a nicotine spray, but in most cases there is no treatment.

Melons and cucumbers are attacked by aphids and by the melon worm. Treatment by spraying with nicotine and with lead arsenate is rare.

Eggplant is attacked by a lace wing bug. No method of control is adopted.

Many vegetable crops, including tomatoes, carrots and beet, are at times attacked by eel worm.

Vegetable cultivation in Antigua is on a very small scale, except in the case of tomatoes, and, consequently, little attempt has been made to control pests.

As regards diseases, tomatoes suffer at times from *Cladosporium fulvum*, and frequently, during dry spells, from blossom end rot. It is unusual to attempt to control the former, which is not generally a severe trouble, but attempts have been made to control blossom end rot by avoiding the use of unrotted manure, and by trash mulching to regulate loss of soil moisture. A phoma fruit rot is also occasionally found.

Relation of Production to Local Requirements

Production of vegetable crops is definitely inadequate with respect to what should be the nutritional requirements of the population, but, in practice, only a small percentage of the population eats the vegetables under discussion, and during the cool season production is, on the whole, adequate for the demand. During the hot season, especially when the weather is dry, vegetables are scarce, and importations, particularly of carrots and, occasionally, tomatoes, are sometimes made from Montserrat. The quantities imported are small and vary greatly from year to year.

It is customary during the winter months for tomato production to exceed local consumption, and, in pre-war days, there was an export trade to Canada.

Production for Export

The only vegetable exported on anything other than a very small scale is tomatoes. Exports went almost entirely to Canada. War conditions brought the export trade to an end after 1940-1941.

No facilities exist for processing fruit too small or otherwise unsuitable for shipment, and this fact has been a serious handicap to the industry.

There was an export trade in onions several years ago, but for various reasons this has declined, and it had practically ceased before the outbreak of the war.

Organization of Production for Export

The tomato is the only vegetable whose production could be considered to assume the status of a local agricultural industry. Onion production would have increased greatly after the outbreak of the war, if it had not been for the difficulty experienced in obtaining seed.

The seed supply is obtained annually from the United States and sold by the Agricultural Department. Under peacetime conditions, small importations are made during most months of the year, but the bulk of the seed is imported in time for planting in September, October and November.

Tomato production is chiefly a peasant industry.

No information is available as to the acreage planted. This is never large, and varies from season to season, depending on the rival attractions at the time of other crops, such as cotton, and on the prices likely to be realized.

Tomatoes are grown both as a pure stand and as a catch crop on cane fields. In the former case the plants are generally spaced at about 2 feet - 3 feet apart in rows 4 feet apart. When they are grown as a catch crop in cane fields, spacing is much wider.

It is unusual to stake and prune tomatoes. Higher yields are obtained with pruned and staked plants, but labor costs are high, and pruning and staking do not appear to be economically sound.

Exact figures for yield data are not available. Individual records from commercial growers have varied from 2,000-10,000 lb. per acre.

Experiments conducted by the Agricultural Department have shown yields of American varieties to vary from 4,000-9,000 lb. per acre. Of English varieties which bear smaller fruit, yields vary from 10,600-16,000 lb. per acre.

The only marketing organization is the Marketing Branch of the Agricultural Department. All fruit exported pass through this organization. Local sales are made through this organization and by direct contact between grower and consumer.

Prices for 20 lb. crates, c.i.f. Canada, are as follows, in Canadian currency:

Average	\$1.50
Highest	\$2.25
Lowest	\$0.75

In any given year the price per lb. has depended on the time during the season when shipment was made, and on the size of the fruits.

Some measure of preference has been given British West Indian tomatoes in the Canadian market. The tariff, however, has varied from time to time even during the same year. There is no export tax on tomatoes.

Local Methods of Preservation and Storage

There are no local methods of preservation, except the home bottling of a type of tomato paste on a very small scale.

As regards storage, the Marketing Branch of the Agricultural Department, during the years when tomatoes were being exported, had at its disposal a small cold storage space which was used to store tomatoes (picked full green) until a shipping opportunity occurred. Shipment was made every fortnight. This cold storage space was quite inadequate.

Numbers Engaged in Production

No information is available as to the number of persons engaged in vegetable production. In no case does vegetable production give full time employment, and the number occupied even in part time work is not great.

Legislation

There is no legislation directly affecting vegetable production. Export is regulated by the Exportation of Fruit Ordinance, No. 13 of 1938, which makes provision for the inspection of fruit and vegetables exported.

Research

Very little research work has been conducted with vegetable crops.

The Agricultural Department has made a few varietal and cultural experiments with tomatoes, and observation plots have been grown with various other vegetables. No thorough planned investigations have ever been made with vegetable crops.

In 1929 experimental canning of tomatoes and certain tomato products was undertaken at the Government Laboratory. This laboratory was closed and disbanded in 1936. The quality of the product was fair, but production costs were unduly high, and nothing came of the venture.

Extension Service

The Agricultural Department, more especially the Peasant Branch, has encouraged the growing of vegetables. Limited numbers of seedling tomatoes, onions, cabbages and cauliflower have been available for purchase by growers, and demonstration plots have been planted at various centers.

Local Associations

There was at one time an Onion Growers Association, organized in close association with the Agricultural Department. But since the decline of the export trade in onions, this association has not functioned. At present the Marketing Branch of the Agricultural Department and the Department's field section are the only organizations existing for promoting the production and marketing of vegetable crops.

Wartime Developments

As a result of war conditions, every effort was made by the Agricultural Department to increase local food production. More successful results were obtained, however, with corn and certain root crops than with vegetables. But, on the whole, there has been increased production except of tomatoes, the export market for which entirely disappeared.

The reasons why less success was obtained with vegetables than with other food crops have been the smaller demand, the greater cost of production, the poor prices obtainable in seasons of plenty, and the control of prices which prevents growers in times of scarcity from making such big profits that they are willing to risk the losses due to poor crops and poor markets when crops are large and the market glutted.

MONTserrat

Varieties

Type	Vegetable	Variety	
(a) Leaf and Stem Vegetables	Cabbage	Succession; Creole; Longfoot (local)	
	Cauliflower	Early Patna	
	Chinese Cabbage	Early White Vienna	
	Kohl-Rabi	Yellow Bermuda; Crystal	
	Onion	Wax (White Bermuda); Red Bombay	
	Watercress		
	Shallot	Local Variety	
	Spinach		
	(b) Salad and Fruit Vegetables	Lettuce	Mignonette; Tom Thumb
		Tomato	Marglobe
Pepper		Local Varieties: Peggy Mouth; Bird Pepper	
Okra		Local Variety	
Eggplant		Black Beauty; Local Varieties	
(c) Gourds and Pumpkins	Cucumber	Mincu	
	Melon	Local Variety	
	Pumpkin	Local Variety	
	Christophine (Chayote)		
	(<i>Sechium edule</i>)		
(d) Root Vegetables	Beet	Detroit Dark Red	
	Carrot	Chantenay	
	Turnip	Golden Ball; Purple Top White Globe	
(e) Flavoring and Seasoning Herbs	Mint		
	Parsley		
	Chive		
	Thyme		

Seed Supply

The Agricultural Department imports seed as follows:

Vegetable	Variety	Country
Cauliflower	Early Patna	India
Onion	Yellow Bermuda; Crystal Wax (White Bermuda)	Teneriffe
Cabbage	Succession	U. S. A.
Lettuce	Mignonette	U. S. A.
Tomato	Marglobe	U. S. A.
Beet	Detroit Dark Red	U. S. A.
Carrot	Chantenay	U. S. A.
Turnip	Golden Ball; Purple Top White Globe	U. S. A.

The Department stores such seed in cold storage, when necessary, re-packs and retails it to vegetable growers. Some vegetable growers themselves import seed from the United States.

The Department produces and retails a few pounds of seed of Red Bombay onion each year. Apart from this, very little vegetable seed produced locally is planted.

Local Commercial Nurserymen

There are no local commercial nurserymen, but general storekeepers occasionally import and resell packets of vegetable seed.

Organization of Production

Carrot, turnip, beet, onion and, in normal times, tomato are grown as a subsidiary part of large scale agriculture on some estates. However, with the cessation of refrigerated steamship service to Canada during the war, the tomato industry virtually disappeared.

Onion and tomato are grown by many peasants, and carrots by a few.

Ecological Considerations

Vegetables are grown on most of the soil types of the Island. Little is known as to the suitability of the various soil types to particular crops. Carrots, turnips and beet are mostly grown at altitudes of from 600 to 1,200 feet, and other vegetables from sea level up to 1,500 feet. The annual rainfall varies from place to place and from year to year, and probably averages something like 60 inches. Excess rainfall may cause serious fungal diseases in tomatoes, and drought conditions sometimes retard or reduce production in all crops.

Problems of Cultivation

Problems affecting cultivation are largely connected with the maintenance and improvement of soil fertility and water supply.

Diseases and Pests

Tomatoes are usually attacked by green bugs and fruit-boring caterpillars, and by several fungus diseases which cause decay in the fruit. Cabbages are often severely damaged by caterpillars. Little is done in the way of control.

Relation of Production to Local Requirements

The relation of the production of most of the vegetables under discussion to local requirements depends on weather conditions, time of year and the export market. At times production of most vegetables is inadequate. Onions may then be imported, but, as

regards other vegetables, little is done by importation to meet shortages. Onions, carrots, turnips, beets and, in normal times, tomatoes are grown for export, and when these crops are in season, roughly for a few months around March, are generally available for consumption in the Island. Surpluses may be sold locally by direct sale by grower to consumer, or through hucksters who sell in the Public Market, Plymouth, or from door to door.

Organization of Production for Export

Tomatoes. As mentioned above, the local tomato industry is at present of very limited scope. The following description refers to pre-war years.

Seed was imported from the United States of America, usually by the Agricultural Department, which retailed it. Only the Marglobe variety was grown. Part of the crop was grown by various estate owners, and a large proportion by peasants. Individual plantings were often so small that an estimate of total acreage is difficult; perhaps it totaled 200 acres each year. Seeds were sown in nursery beds, and the seedlings planted 18 inches apart on ridges 4 feet apart. The plants were not staked, and little pruning was done. Sometimes a little farmyard manure was used. Yields varied from about 1,000 lb. to 8,000 lb. per acre, probably averaging something like 4,000 lb. per acre. Practically the entire crop was shipped to Canada during the period February to May. A Government Marketing Depot, run by the Agricultural Department, packed and marketed a considerable portion of the crop. The tomato crop was dealt with in four different ways:

- (a) received, mostly in small quantities, from growers, and pooled, packed and shipped by the Government Marketing Depot;
- (b) received, in larger quantities, from growers, and packed, shipped and separately accounted for by the Government Marketing Depot;
- (c) packed at private packing stations and shipped by the Government Marketing Depot;
- (d) packed and shipped by private shippers.

The whole crop was handled at the Canadian end by three buyers. Approximately 350 to 450 tons were shipped to Canada each season. Prices fluctuated greatly according to quality at time of shipping, time taken in distribution, and state of the market, and during the

four years before the industry was brought to a standstill by the war, returns to growers per ton of tomatoes packed and marketed by the Government Marketing Depot ranged from nil to £37. 5. 0. The value of tomatoes exported each season was around £5,000. An export duty on tomatoes is levied at the rate of a halfpenny per crate of approximately 20 lb.

Onions. Onions assume the status of only a small agricultural industry. Seed is imported annually by the Agricultural Department, stored when necessary, re-packed and retailed. The crop is grown on a small scale by estate owners and peasants. There are no figures available as to acreage; in some instances, the crop is very widely spaced as a catch crop before planting cotton. The seed is sown in nursery beds about November, and planted out on ridges about the end of December. As onions are generally planted as a widely spaced catch crop, it is rather difficult to estimate yields; but where they are planted as a main crop, the yield might amount to 2 tons per acre. The crop is harvested about March. Part of it is consumed in Montserrat, part shipped to Antigua, and usually a fair quantity to Barbados. Shipments may be made by growers or by buyers. The quantity expected each year amounts to approximately 15 tons.

Carrots, Turnips and Beets. In spite of difficulties, this trade has more or less retained its status throughout the war. Turnips and beet are grown on two estates near the center of the Island at an altitude of about 1,000 feet. Most of the carrot production is grown on the same estates, but there is a growing tendency on the part of a few peasants to grow small quantities of this crop. Seed is imported from the United States of America by the Agricultural Department, kept in cold storage when necessary, re-packed and re-sold to growers. Sometimes, growers make direct importations. The total acreage planted under these three crops might amount to 30 acres per year, carrots greatly predominating in acreage over the other two. All three crops are usually planted on ridges somewhat flattened into narrow beds. Yields of carrots range from 2 to 5 tons per acre. The crops are usually marketed by the growers. The bulk of the crop goes to Trinidad, a fair amount to Antigua, and a portion is consumed locally. In 1945 exports amounted to: carrots, 70 tons; beets, 4 tons; and turnips, 2 tons. Returns during the war period fluctuated widely, one reason being the lack of either refrigerated or fast shipping services between Montserrat and Trini-

dad. Losses due to spoilage in transit in sailing vessels or in unrefrigerated storage on steamers have been serious.

Local Methods of Preservation and Storage

There are no facilities for the centralized preservation of vegetables, and very little, if any, home preservation is done. The Agricultural Department operates a Cold Storage Depot, which is used for the pre-cooling and storage of tomatoes, carrots, turnips and beets. It is used mainly for storage while a shipment is being accumulated, or while a shipment is being held awaiting a shipping opportunity. It can accommodate about 40 tons of vegetables.

Numbers Engaged in Production

Few, if any, persons in Montserrat are in whole time employment in the vegetable industry. But in normal times a very large number of persons are employed on a part time basis. In one year before the war 1,148 persons brought tomatoes to the Government Marketing Depot. Onion production is to a great extent subsidiary to the cotton industry, and makes a small contribution towards providing all-the-year-round employment. The carrot, turnip and beet crops provide only part time employment.

Legislation

The Exportation of Fruit Ordinance, 1938, together with Rules made under it, provide for the inspection of vegetables for export and their standardization, control of packing houses, the control of the Government Cold Storage Depot, etc.

Extension Service

The Agricultural Department keeps in review the production of vegetables, but research work and extension work on production are scanty. As already indicated, the Agricultural Department assists the industry by means of its services in importing seeds, providing a central Government Marketing Depot for tomatoes and a Cold Storage Depot for all vegetables for export, inspection service, etc. The Department has also, to some extent, arranged the bulk importation of packing materials, especially during the war. In normal times a Fruit Advisory Committee assists in regulating the shipping and marketing of vegetables.

Wartime Developments

The main effect of the war has been the virtual cessation—temporary, it is hoped—of the tomato industry. The carrot industry tended to expand. Demands from Antigua and other nearby Islands gave stimulus to the increase of production of such items as cabbage.

ST. KITTS-NEVIS

Varieties

<i>Type</i>	<i>Vegetable</i>	<i>Variety</i>
(a) Leaf and Stem Vegetables	Cabbage	Succession
	Cauliflower	Early Patna; Early Benares
	Onion	Yellow Bermuda
	Shallot	
	Spinach	New Zealand; Princess Juliana
	Kohl-Rabi	Early White Vienna
(b) Salad and Fruit Vegetables	Lettuce	Mignonette
	Tomato	Marglobe; Ponderosa
	Sweet Pepper	California Wonder
	Okra	Lady's Finger; Common
	Hot Pepper	Long Red Cayenne; Bird Pepper
	Eggplant	Black Beauty
(c) Gourds and Pumpkins	Cucumber	Long Green; Common
	Melon	
	Cantaloupe	
	Muskmelon	
	Watermelon	
	Squash	
(d) Root Vegetables	Beet	Early Flat Egyptian; Detroit Dark Red
	Carrot	Chantenay; Danvers Half Long
	Jerusalem Artichoke	
	Turnip	Purple Top White Globe
	Radish	French Breakfast
(e) Flavoring and Seasoning Herbs	Parsley	Extra Curled Dwarf
	Mint	
	Thyme	
	Sage	
	Sweet Marjoram	

Seed Supply

Practically all the vegetable seeds used in the Presidency are imported from the United States. The seeds are imported in bulk by the Federal Department of Agriculture in Antigua. Much of the seed supply in St. Kitts is stored in large desiccators over calcium chloride or quicklime. Vegetable seeds are sold to growers at the Government Experimental Station in St. Kitts.

Onion seed is imported from Teneriffe, and cauliflower seed from India.

Some eggplant and tomato seeds are produced locally at the Experimental Station. There are no commercial seedsmen.

Organization of Production

Vegetables are produced as a subsidiary part of small scale agriculture, and in small gardens in towns and villages.

Ecological Considerations

Vegetable crops suffer severely during periods of drought, and great care has to be exercised to keep the plants alive. Most vegetable crops will grow satisfactorily in all districts of the Island, but do best in the cool upper lands.

Diseases and Pests

Vegetable seedlings are sometimes seriously damaged by cutworms (*Prodenia*) and damping-off fungi. Growers are advised to protect the seedlings with poison bait for cutworms, and to treat them with Cheshunt Compound for control of damping-off fungi.

The principal pests of cabbage and cauliflower are the diamond-back moth (*Plutela maculipennis*) and the white butterfly (*Ascia monuste*). Growers are advised to hand-pick eggs and larvae regularly. Spraying with lead arsenate, when the plants are young, is also advised.

Melons, cucumber and eggplant may be seriously damaged by the melon aphid (*Aphis gossypii*). For control, growers are advised to spray with nicotine sulphate and soap, or with soap and water alone.

Onions are sometimes seriously damaged by attacks of thrips.

Relation of Production to Local Requirements

The production of green vegetables in the Presidency is seasonal. Good supplies are usually available during the wetter and cooler periods of the year (November to March). For the remainder of the year supplies are inadequate to meet local requirements.

Production for Export

There is no "agricultural industry" in vegetables. Before the war small quantities of tomatoes and vegetables were exported from St. Kitts and Nevis to Canada and Bermuda. Exports of vegetables to Canada were all graded and packed under Government supervision at central depots.

Legislation

Legislation is in force requiring that the grading and packing of vegetables for export to Canada must be done under Government supervision. There is no legislation affecting vegetable production.

Extension Service

Information regarding the cultivation of vegetables is given to growers through the Agricultural Instructors on the staff of the Department of Agriculture.

Local Associations

There are Fruit and Vegetable Associations in St. Kitts and Nevis, but these have not functioned for several years.

Wartime Developments

The cultivation of green vegetables increased considerably in the Presidency during the period of the war.

There is no "agricultural industry" in vegetables. A few small quantities of tomatoes and vegetables were exported from St. Kitts and Nevis to Canada and Bermuda. Exports to Canada were all graded and packed under Government supervision at central depots.

PUERTO RICO

General Considerations

After 1930, when the grapefruit industry for export to the United States began to decline, vegetable growing for export during the winter season appeared as a promising substitute. The most important vegetables produced for this purpose were cucumbers, tomatoes, peppers, eggplant and squash. Up to 1942, when shipping facilities ceased due to the war, the production of vegetables for the winter market of New York had increased considerably. However, the lack of shipping space during the early months of 1942 caused a sharp decline in the production of fresh vegetables for export. Since that time vegetable production has been restricted again to a local business.

It should be borne in mind that the food habits of the average Puerto Rican do not call for a large supply of fresh vegetables, as is usually the case in the United States or other countries. In fact, several of the vegetables under review are practically absent in the Island's markets, local production being insignificant. These unimportant vegetables are celery, cauliflower, head lettuce, melons, mustard, broccoli, kohlrabi, mint, thyme, squash, dill, endive, brussels sprouts, collards and parsley. In normal times some of these vegetables are imported in minor quantities from the United States for the larger markets of San Juan, Ponce, Río Piedras and Mayagüez.

Limited quantities of carrots, radishes, celeriac, watermelons, beets, turnips and watercress are produced intermittently for the local markets of the larger towns and cities. In general, it may be stated that the most common vegetables raised in the Island, exclusive of legumes and root crops, are: tomatoes, cucumbers, cabbage, peppers, eggplant, pumpkins, okra and leaf lettuce.

<i>Type</i>	<i>Vegetable</i>	<i>Variety</i>
(a) Leaf and Stem Vegetables	Cabbage	All Head Early; Burpees Surehead; Early Flat (round) Dutch
	Chinese Cabbage	Chihli; Wong Bok
	Cauliflower	Early Patna; Early Market
	Watercress	Local Variety
	Onion	Yellow Bermuda; Red Bermuda; Red Creole
	Asparagus	Mary Washington (grown experimentally at the Isabela Substation of the Agricultural Experiment Station of the University of Puerto Rico)
(b) Salad and Fruit Vegetables	Lettuce (leaf)	Black-Seeded Simpson
	Lettuce (head)	Imperial 44
	Tomato	Marglobe; Pan American; Dwarf Stone; Stokesdale; Bounty; Local Variety
	Pepper	California Wonder; Ruby King; Worldbeater; Florida Giant; Chinese Giant; Pimiento; Red Chili; Early Neapolitan; Local Varieties
	Okra	Clemson Spineless; White Velvet; Perkins Long Pod; Local Varieties
	Eggplant	Florida High Bush; Black Beauty; Rosita; Local Varieties of light purple color (black varieties generally grown for export; varieties for local consumption are light pink, light purple or white in color)
(c) Gourds and Pumpkins	Cucumber	Puerto Rico 39; Early Fortune; Black Diamond; Davis Perfect
	Melon	Honey Dew (Green); Cuban Castilian; Smith's Perfect; Local Variety
	Watermelon	Tom Watson; Local Variety
	Pumpkin	Large Cheese; Small Sugar; Local Variety
	Squash	White Bush Scallop (Patty Pan); Early Prolific Straightneck
	Christophine (Chayote)	Local Variety
(d) Root Vegetables	Carrot	Tendersweet; Chantenay; Danvers Half Long
	Beet	Early Wonder; Crosby's Egyptian
	Turnip	Purple Top White Globe; White Egg
	Celeriac	Local Variety
(e) Flavoring and Seasoning Herbs	Radish	Early Scarlet Globe
	Coriander	Local Varieties
	Garlic	Local Variety

Seed Supply

There is a group of seeds that are not, or cannot be, produced locally—for example, tomato, onion, radish, cabbage, pepper, watermelon. These seeds are imported almost entirely from the United States. Some of these seeds are not produced locally because their production requires some degree of specialization, and extra care and purchase of equipment that would not be a profitable enterprise when compared with other simpler agricultural activities. Other seeds of this group cannot be grown in Puerto Rico because latitude and climatic conditions are not suitable for such enterprises. This is the case with onion, radish, beet, turnip, cabbage and cauliflower.

Onion seed, which is imported from the Canary Islands and the United States, is obtained through a few local agents. The other seeds are either imported directly from the seed companies in the United States, or are purchased from two or three local agents. During the last six or eight years a number of Government agencies, such as the Insular Department of Agriculture, the Agricultural Experiment Station of the University of Puerto Rico, the Puerto Rico Reconstruction Administration, the Puerto Rico Emergency Relief Administration, the Office of Food Distribution, the Extension Service and the Vocational Schools, have distributed vegetable seeds either free or at a nominal price.

None of the private or Government agencies which import vegetable seeds have adequate storage facilities. There are no specialized seed stores, the seed business being a minor enterprise or a sideline of a few private concerns. There are no seed storage warehouses where temperature and relative humidity could be properly controlled to maintain the viability of certain seeds. Even the common storage facilities are not rat-proof or insect-proof. The few private seed agencies which operate in the Island do not have adequate storage facilities, neither do they carry a constant supply of vegetable seeds.

Personnel from the Farm Security Administration, the Insular Department of Agriculture and the Extension Service help vegetable growers in making their seed orders. These agencies help also in distributing seeds free of charge or at a nominal cost, when such seeds have been purchased by one of the various Governmental agencies which try to foster local production of vegetables.

A few seeds, like coriander, hot pepper, chayote, native pumpkin, native melon and watermelon, are home grown. Vegetable grow-

ers who do not have these seeds simply purchase them or obtain them from their neighbors. Coriander seed is usually found for sale in the local vegetable markets.

There are no commercial seedsmen engaged in the local production of vegetable seeds. The service of seed production and distribution is offered only to a limited extent by the Puerto Rico Experiment Station at Mayagüez, the Agricultural Experiment Station at Río Piedras, and the Extension Service.

The Río Piedras Station and the Extension Service, through the Demonstration Farms, propagate and distribute the following vegetable seeds: Smith's Perfect melon, Rosita eggplant, and Puerto Rico-39 cucumber.

The storage facilities of the Government agencies for these locally grown seeds are much better than those used by the private commercial agencies which import seeds. In fact, one of the Government agencies, the Río Piedras Station, has cold storage facilities for preserving locally produced vegetable seeds. It has also a specially built fumigation room for the proper treatment of certain seeds. This agency is building another cold storage warehouse at the Isabela Substation for the preservation of seeds. So far, the Río Piedras Station has the more permanent and satisfactory seed production program, though on a limited scale.

The seeds produced by the different agencies are generally distributed directly by the agencies themselves, or through such other agencies as the Extension Service, the Farm Security Administration, the Puerto Rico Reconstruction Administration, the Vocational Schools of the Department of Education, and the Department of Agriculture of the Insular Government.

Organization of Production

During normal times, before the United States entered the war, a considerable proportion of the Island's vegetable production, either for export or for local consumption, was supplied by marketing cooperative associations established at Río Grande, Isabela, Jayuya and Villalba. An extensive report on the operations of the first three of these cooperatives has been published by the Agricultural Experiment Station at Río Piedras. These cooperatives were engaged mostly in the production of such vegetables as cucumbers, tomatoes, peppers, eggplant, squash and string beans. Though the cooperatives were originally established for marketing purposes,

they helped farmers also in the purchase of equipment, fertilizers, insecticides and containers. The sale of the produce through a central marketing cooperative organization enabled farmers to obtain loans from the Emergency Crop Loan Office and from the Puerto Rico Reconstruction Administration.

After war was declared by the United States, shipping facilities declined markedly, and, consequently, the activities of some of the cooperatives ceased or were drastically curtailed. In these cooperatives the production of vegetables for the local trade was a sideline of the main business, which was exportation of fresh produce to New York during the winter season.

The bulk of the Island's vegetable production is supplied by farmers engaged in small scale agriculture. Near the large towns and cities there are several market gardeners who produce in limited amounts leaf lettuce, radishes, turnips, carrots, peppers, eggplant and other vegetables.

A few progressive farmers who diversify their crops properly have combined sugar cane production with vegetable growing on a small scale. These farmers have made successful interplantings of tomatoes, squash, cucumbers, watermelons and melons in the newly planted sugar cane fields. The slow germination of the sugar cane cuttings and their gradual growth during the first two or three months make possible intercropping with the short period vegetables mentioned above. Sugar cane ratoons have also been intercropped with cucumber, watermelon and squash.

Ecological Considerations

A large proportion of the various soil types of the Island does not offer the proper conditions for raising successfully the vegetable crops under discussion. The heavy soils are either too dry or too wet during most of the year, conditions which make farming operations in vegetable growing rather difficult. Heavy soils which retain moisture persistently are not suitable for growing vegetables, due to root and bacterial diseases, such as bacterial wilt of tomato, eggplant and pepper. In general, rainfall distribution is not adequate for vegetable growing. Heavy rains during a short period are liable to destroy a great number of vegetable crops; outbreaks of diseases are common under such conditions. On the other hand, even brief periods of drought are also very detrimental to such short season crops as cucumbers and squash.

The most appropriate regions for growing these vegetables are the dry areas with irrigation facilities. However, these regions are mostly devoted to large scale cultivation of sugar cane—for example, the southern coast of the Island. The northwestern section of the Island, with loose, friable soils, dry weather and irrigation facilities, is also specially adapted for vegetable growing. From 1930 up to 1942 a vegetable cooperative association operated successfully in the irrigation district of this part of the Island. Its main business was the exportation of fresh produce for the winter market of New York. This cooperative raised satisfactorily such crops as cucumbers, chayote, watermelons, peppers, tomatoes, eggplant, string beans and lima beans.

No research work has been undertaken to measure the effect of seasonal influences on the production of vegetable crops. However, it has been observed that certain vegetable crops are more susceptible to insect damage during the dry spells than during the rainy season. For example, onions are generally planted during the months of September, October and November, when rain is sufficient for that crop. If planted later, development would take place during the dry months of January, February and March, when thrips infestation is more prevalent and would probably cause crop failure. The same is true of aphids attacking cucumbers and squash during dry weather. Heavy showers seem to be a natural control of thrips and aphids.

At the Isabela Substation it was observed that leaf lettuce and head lettuce grow better during the fall and winter than during the spring and summer months. No heading was observed in head lettuce grown in spring or summer. All lettuce varieties were more affected by diseases and insects during the spring and summer months than during the fall and winter. During the summer months lettuce is affected badly by leaf hoppers and by leaf spot diseases. As a general rule, diseases of vegetable crops are more prevalent during the rainy season.

Problems of Cultivation

The proper raising of vegetable crops requires more care for control of diseases and pests, better cultivation methods and better trained personnel, than are generally needed for raising the easy growing food crops of the Island, such as tannias, bananas, plantains, yuca, sweet potatoes, yams and pigeon peas. Farmers used

to growing these crops are liable to fail when attempting to become vegetable growers.

The numerous problems of cultivation, drainage, irrigation, harvesting, weed control and fertilization for vegetable crops have not been fully studied.

Diseases and Pests

Insect and disease control measures have been properly studied, but, generally, vegetable growers are not inclined to follow the recommendations given. This is due in part to the fact that there is no adequate local supply of insecticides, fungicides and spraying equipment. A large proportion of the vegetable growers cannot afford to purchase the costly materials and equipment for applying the control measures recommended, especially in the face of market risks. Also, there is a natural tendency to wait until diseases and insects appear before applying the recommended control measures. Only repeated failures teach that prevention is the best control.

For certain diseases and pests of vegetable crops, fungicides and insecticides have been recommended, some as preventive measures, and a few as direct control measures. Also, successful results have been obtained in the control of a few diseases by the development or introduction of resistant varieties.

Relation of Production to Local Requirements

Vegetables are grown in Puerto Rico in small quantities mostly for home consumption, except for some amounts which are raised commercially for export to the United States during the winter months. Among the latter group are found tomatoes, peppers and cucumbers.

Vegetable growing on a commercial scale is a risky, hazardous venture, which only farmers supplied with sufficient technical skill and ability may enter into with reasonable chances of success. Vegetables are also intensive crops, thus requiring heavy outlays of money before they are finally harvested and sold at market. The demand for vegetables in Puerto Rico is small. Mainly owing to their perishability and riskiness, the retail prices at which they are sold are high, and thus, for the most part, lie beyond the means of the vast majority of the population with characteristically low incomes at their disposal. Food habits and lack of sufficient education in the high nutritive values contained by most vegetables likewise contribute to a low consumption. Green and leafy vegetables constituted

6 per cent of the total food consumed in the Island in 1937-1938, measured from the standpoint of quantity. Yearly *per capita* supply was estimated at 58 lb.

Production for Export

Seed is imported from the United States. The following are the most important concerns supplying seed to the Island: Henry Maule, Kilgore Seed Co., Burpee's, Peter Henderson, Hastings.

The following table gives statistics of the vegetables cultivated for export:

Summary of Estimated Acreage, Yield, Total Production and Value of Winter Vegetables Grown for Export to the United States, 1939-1940

<i>Crop</i>	<i>Estimated acreage (cuerdas)¹</i>	<i>Average production per cuerda²</i>	<i>Estimated total production³</i>	<i>Average price per package (\$)</i>	<i>Total value (\$)</i>
Tomatoes	986	200	197,200	2.15	423,980
Cucumbers	589	200	117,800	2.50	294,500
Peppers	90	225	20,250	2.25	45,563
Miscellaneous ³	65	150	9,750	2.00	19,500
TOTAL	1,730				\$783,543

Vegetables Harvested for Sale 1939, 1935, and 1929*

<i>Vegetables</i>	<i>Farms Reporting</i>		<i>Cuerdas Harvested for Sale</i>		
	1939	1929	1939	1935	1929
Eggplant	1015	1478	332	187	345
Pumpkins and Squash	2389	2081	1188	378	847
Onions	889	881	404	432	377
Lettuce	730	1224	210	180	257
Cucumbers	272	180	321	134	176
Peppers	1864	2202	845	606	619
Okra	483	626	198	170	184
Cabbages	1387	2681	603	297	656
Tomatoes	3459	3437	2125	809	1033
Other	219	—	135	38	273
Total	5259	3728	6361	3231	4767

Local Methods of Preservation and Storage

Few farmers equipped with canning equipment can their vegetable products as a means of preserving them. Others take their products to local canning centers operated by the Agricultural Extension Service of the University of Puerto Rico.

As to storage facilities at the farm these are practically non-ex-

¹ One cuerda equals 0.9712 acres.

² Tomatoes in lugs; cucumbers in one bushel crates; peppers, squash and eggplant in one and a half (1½) bushel crates.

³ Includes snap beans, squash, eggplant and melons.

* Unofficial estimates would probably increase these acreage figures by 10 per cent to include also acreage planted and harvested for home consumption.

istent, except for a few well-to-do famers who possess refrigeration facilities.

There are no centralized cold storage plants for preserving fresh vegetables.

Vegetables grown commercially for export to the United States are usually picked green, stored for one or two days at local picking centers, and sent to San Juan to large refrigeration units pending arrival of steamers. Before the war, there was always one steamer leaving weekly for the United States equipped with refrigeration facilities. Usually, vegetables were not stored at refrigeration centers for more than two or three days.

Processing

Practically there is no vegetable processing center operating in Puerto Rico which is worth mentioning. Vegetables are mostly consumed fresh, when available. One local cooperative once canned tomato sauce as an emergency measure when no export facilities were available. Results were far from encouraging, as competition offered by similar United States products limited these sales considerably.

Numbers Engaged in Production

Man Days Required in Vegetable Production	
<i>Vegetable</i>	<i>Man Days</i>
Eggplant	30544
Pumpkin and Squash	48708
Onion	37168
Lettuce	8400
Cucumber	29532
Pepper	77740
Okra	7920
Cabbage	24723
Tomato	195500

Legislation

(1) According to regulations of the Fair Labor and Standard Act, vegetable cooperative associations are compelled to comply with a law that provides a minimum wage of 15 cents per hour for graders, packers and other employees.

(2) Vegetables imported into and exported from Puerto Rico are subject to quarantine inspection directed towards preventing the introduction of new pests and diseases.

(3) The Coastwise Shipping law compels the use of United States bottoms in regard to the transportation of winter vegetables from Puerto Rico to the United States. Thus, transportation freight rates

are very high and add considerably to the total cost of putting produce on the United States market.

Research

The limited research work undertaken has followed the lines of production. No research work has been done in regard to storage and preservation processes for vegetables.

Some research has been and is still being conducted regarding certain production aspects of the vegetable industry, notably studies in varieties, breeding, fertilizers, disease and insect control, distances of planting, and irrigation.

The investigational work on production of vegetables has been done chiefly by the Agricultural Experiment Station at Río Piedras and the Puerto Rico Experiment Station at Mayagüez.

Extension Service

The Agricultural Extension Service, mostly through the services of its horticulturist, carries out important educational work in connection with the production of vegetables in the Island. Major emphasis is laid on scientific practices and methods of producing and handling vegetables for home consumption. Especially during the war years, the campaign designed to stimulate production of garden vegetables was greatly intensified through Victory Garden Programs. The results of the Victory Campaign as carried out by the Extension Service during the calendar year 1943-1944 were as follows:

Total number of Victory Gardens established in rural and urban areas by adults and 4-H clubs	23,744
Average size of garden, acres	0.15
Total average in gardens, acres	3694.48
Total production of vegetables, lb.	13,936,512

Local Associations

Membership and Volume of Business of Active Vegetable Cooperative Associations in Puerto Rico, 1943-1944

<i>Cooperative</i>	<i>No. of members</i>	<i>Volume of business (\$)¹</i>
Jayuya	174	72,396.89
Villalba	257	186,905.52
Lares	109	33,184.20
La Plata	141	45,036.52
Utuaedo	176	— ²
Total	857	337,523.13

¹ Gross receipts.

² No information available.

Wartime Developments

The lack of shipping space during the years of war caused a marked reduction in the planting of vegetables for the local and export trade, such as tomatoes, peppers, cucumbers and squash. This fact, coupled with a reduction in the local supply of fertilizers, insecticides, fungicides, spraying equipment, and other farming equipment, still further decreased vegetable production.

SURINAM (NETHERLANDS GUIANA)

Varieties

The principal vegetables cultivated are as follows:

- (a) Leaf and Stem Vegetables—cabbage, cauliflower, spinach, leek, endive
- (b) Salad and Fruit Vegetables—lettuce, celery
- (c) Gourds and Pumpkins—pumpkin
- (d) Root Vegetables—beet
- (e) Flavoring and Seasoning Herbs—parsley

Several wild vegetables, all bearing local names, are also sold in the local market.

No information is available as to varieties.

Seed Supply

Seed is partly supplied by the Government, partly stored by farmers from their previous crop.

Organization of Production

All farmers and small holders cultivate vegetables.

Ecological Considerations

The principal soil types are clay (heavy and not so heavy) and sand.

Diseases and Pests

Considerable damage is caused by insects, and for this reason it is impossible to keep vegetables long.

TRINIDAD AND TOBAGO

Varieties

<i>Type</i>	<i>Vegetable</i>	<i>Variety</i>
(a) Leaf and Stem Vegetables	Cabbage	Stein's Flat Dutch; Charleston Wakefield
	Cauliflower	Early Patna
	Onion	White Bunching (Nebuka)
	Shallot	
	Kohl-Rabi	
(b) Salad and Fruit Vegetables	Celery	
	Lettuce	Mignonette; Paris White; White Boston or Big Boston
	Tomato	Marglobe; Ponderosa; Local Varieties
	Eggplant	
	Pepper	
	Okra	
(c) Gourds and Pumpkins	Cucumber	Local Varieties
	Watermelon	
	Pumpkin	
	Vegetable Marrow	
(d) Root Vegetables	Beet	
	Carrot	
	Turnip	
	Jerusalem	
	Artichoke	
(e) Flavoring and Seasoning Herbs	Mint	
	Parsley	
	Thyme	
	Chive	

Seed Supply

With the exception of onions, the seed supply of leaf and stem vegetables is imported. Imports come from the United States, except cauliflower, which is obtained from India. The Department of Agriculture (or the Food Controller in wartime in place of the Department of Agriculture) and private seedsmen import and sell the seed. Distribution in normal times is effected through local shops. Occasionally the Department of Agriculture distributes seed to certain growers.

The seed supply of salad and fruit vegetables is mainly imported. Some small quantities of seed are saved of all these crops (except celery) by native nurserymen and small gardeners for their own use. Imported seed is mainly distributed through the drug stores.

Cucumber seed is saved locally for the most part. Seed of melons and pumpkin is partly saved locally and partly imported from the United States. Distribution in normal times is through shops, as for other vegetable seed.

In the case of root vegetables, practically all seed is imported from the United States, with the exception of turnip, of which some seed is collected locally.

Flavoring and seasoning herbs are grown in very small quantities by people who specialize in their cultivation.

Local Commercial Nurserymen

The number of local commercial nurserymen can be considered large if all the East Indian and Chinese gardeners are included, or very small if only the few specialists are counted. All grow vegetables for sale to vendors and direct to consumers. Many gardeners transport their own produce to market and there sell to wholesalers.

Organization of Production

Vegetables are produced in whole time market gardens, on land settlements to some extent, and in kitchen gardens of persons otherwise employed. They are never produced as a subsidiary part of large or small scale agriculture, except in lagoons, where they may follow rice as a dry season crop.

Ecological Considerations

Leaf and stem vegetables are grown on flat alluvial soils with about 60 inches rainfall per annum. The majority are produced in the dry season, from January to June, while few are produced on the hills in the wet season.

Tomato, pepper and okra are often grown in the wet season on hill slopes. The wet season crop is small and poor, but the price is usually very high.

Melons and pumpkins are grown in large quantities in the lagoon areas in the dry season following rice. Pumpkins and cucumbers are grown practically everywhere, and at all seasons of the year.

Root vegetables are grown almost entirely as dry season crops on flat soils, or, occasionally as wet season crops on hills in all

districts, but mostly in areas where soil is light and with plenty of humus.

There are few local vegetables which are favored to the degree that "English" vegetables are, both by foreigners and natives, and there is thus the constant urge to grow vegetables which are not suited to the climate. Their poor yield under unfavorable conditions tends to raise prices, but, even at the absurdly high levels which these prices sometimes reach, there is little profit made. For example, tomatoes often are a complete failure, but, if they do thrive, average less than 1 lb. of fruit per tree. In recent years more attention has been given to local vegetables.

Among the introduced vegetables certain types stand out as being successful, e.g. Early Patna cauliflower, from seed set in and around Bombay in India, and Mignonette lettuce.

The majority of the introduced vegetables are grown in the dry season, on account of the fact that their chance of survival when the heavy rains begin is small. For some time consideration has been given to the fact that it might well repay market gardeners to grow certain of the introduced vegetables such as cauliflower, lettuce and tomatoes under glass in the wet season, and even in the dry season water control in this way may be easier. Several half-hearted attempts have been made to grow vegetables in cultural solutions, but these hydroponic experiments have all failed.

Problems of Cultivation

Cultivation of vegetables is very rudimentary. There is little soil preparation and little use of manure.

Diseases and Pests

Pests and diseases often destroy whole plantings of leaf and stem, salad and fruit vegetables. *Hellula* of Brassicas may be controlled by lead arsenate dust, but this method is not generally practised.

Watermelons are seriously affected in most years by the aphid (*Aphis gossypii*). This is easily controlled by spraying with home-made oil emulsion, but this method is hardly ever practised. Choicer varieties of cucumber, muskmelon and gourd are subject to serious attack by melon worm and pickle worm (*Margaroni* sp.). These can be controlled by spraying with lead arsenate and, to some extent, by cultural treatment which is now under investigation.

Relation of Production to Local Requirements

Production of leaf and stem vegetables is inadequate at times, and small quantities are imported from other West Indian Islands. At other times there is a surplus, causing a glut of the market and rotting of produce in the field. Marketing arrangements will be considerably improved, if the plans made during the war are carried out.

Production of celery is inadequate, but little is imported on account of the cost. Tomatoes sometimes glut the market, though in the wet season they are very scarce. Some imports are made from other Islands.

With the exception of turnips, root vegetables are not much known and used. But production must be considered inadequate, as prices are very high and supplies are scarce all the year round.

Local Methods of Preservation and Storage

No local preservation is attempted. Cold storage is sometimes used for cauliflower. This is a matter which needs serious investigation.

Numbers Engaged in Production

No estimate is possible, as so much part time labor is employed.

Research

Small production experiments have been made from time to time by the officers of the Department of Agriculture and the Imperial College of Tropical Agriculture. With respect to gourds and pumpkins, casual notes have been made on observed behavior.

Extension Service

Advice is given by the Department of Agriculture to peasants in land settlements, in the case of gourds and pumpkins.

VIRGIN ISLANDS OF THE UNITED STATES

Varieties

<i>Type</i>	<i>Vegetable</i>	<i>Variety</i>
(a) Leaf and Stem Vegetables	Cabbage	Early Jersey Wakefield; Copenhagen Market
	Onion	Yellow Bermuda
(b) Salad and Fruit Vegetables	Eggplant	Black Beauty; New York Improved Spineless
	Tomato	Stokesdale; Marglobe; Stone; Bonny Best
	Pepper	Ruby King; Florida Early Giant
	Okra	White Velvet; Clemson Spineless

Seed Supply

All seed is imported through two sources: (1) the Agricultural Experiment Station, which makes purchases on direct orders or Government approved bids; (2) department stores that order seed from companies in the United States and retail it locally. No particular care is given to imported seed. It is kept in the original shipment case until needed. At the Station, however, seed is kept in refrigerators or metal bins with fine wire covers. Seed storage is not a general practice, inasmuch as orders are made to satisfy immediate demand.

Locally no seed is produced on a commercial basis. Farmers may gather seed in order to have some on hand for planting, in the event that imported seed does not come through on time. But this is on a small scale, and cannot be considered a source of supply for other than the individual.

Ecological Considerations

Climatic conditions in the Virgin Islands permit the growing of vegetables during the winter and spring seasons. The bulk of vegetable production is from September through March, when precipitation ranges from 7.55 inches to 1.58 inches, respectively, permitting a moist vegetative period and a dry harvesting season. The temperature ranges from 68°-85° F., and evaporation is lower than at other times of the year. However, during September, October and early November, caterpillars appear and do much damage to vegetable plantings, and are frequently responsible for crop failures at times when other conditions are favorable. Vegetables are grown

on almost any type of soil, although preference is given to loam, sandy loam and clay soils.

Problems of Cultivation

Onion: The most difficult problem is the germination of the seed. Farmers lose 90-100 per cent of onion seed because they fail to provide proper conditions for the growth of this delicate seed. The Station usually plants the seed and then distributes the seedlings to the farmer.

Pepper: The prevention of sunscald is about the main problem connected with the culture of this crop. Small quantities of nitrogen fertilizer are used as a prevention.

Diseases and Pests

Cabbage: The main pests are caterpillars. They are controlled by systematic spraying with calcium arsenate up to the time the heads begin to form.

Eggplant: This crop is very easily grown in the Virgin Islands and is seldom attacked by either insect pests or diseases.

Tomato: The tomato is very easily grown locally. The main problems connected with its culture are found in disease and pest control. The most common disease is blossom end rot, a physiological disorder which causes a decay of the blossom end of the green and ripe fruits. It usually makes its appearance during or after periods of drought, when water is in great demand due to rapid development of the fruit. Improving the moisture-holding capacity of the soil will help to reduce the injury. The most common insect pest is the tomato horn worm, the larva of the large humming bird moth (*Phlegethontius sexta*). It strips the tomato plant of its leaves and punctures the fruit. Hand picking is the best remedy.

Relation of Production to Local Requirements

Production is inadequate largely because (1) farmers do not put sufficient land into cultivation during the normal planting seasons; (2) production is unorganized—no provision is made for storage or preservation of crops. In periods of scarcity the local merchants import fresh and canned goods. But the supply is never sufficient for the demand, and under war conditions shipping was so unreliable that importation of vegetables was not considered practicable.

There are no standardized local methods of preservation or storage. Vegetables are usually left in the field until needed and sold soon after harvesting. Inasmuch as production is limited, no difficulty is encountered in disposing of the crop. Hence there is no need for storage.

Research

Experiments have been largely confined to testing various varieties of imported seed in order to determine which give the best results under local conditions. Plots of different varieties were planted and records made of their production, resistance to drought, insects and disease. The selected varieties have been indicated above. Research was financed by regular budgetary appropriations of the Station.

Extension Service

Vegetable growing in the Virgin Islands is often unsuccessful due to the difficulty in obtaining fresh viable seed, failure to select suitable varieties, and a general tendency to await the advent of wet weather before planting even such vegetable seed as requires seed box propagation. In an effort to encourage and promote planting and bring success to the grower, the Station distributes seed and plants of selected varieties at what is considered the best time for planting. Agents visit the farmers and educate them in the culture of the vegetables, assisting them with the selection of sites, and holding demonstrations on planting, seed selection, control of insects and diseases. Increased and diversified production of crops is stressed, with the aim of improving the farm diet and leaving a surplus for marketing and canning.

Local Associations

The St. Croix Agricultural Association has been organized by the Farm Security Administration. It is a cooperative designed to offer the growers a market for their vegetables in addition to the opportunity of canning their produce for future use.

The Association started the operation of a cannery on February 20, 1945, and produced for market 12,000 cans of tomatoes. The Experiment Station cooperated by allowing the use of its fields for

the planting of a part of the tomato crop used by the cannery. Plans for the following season involved greater land use and extensive planting of vegetables and field crops, including corn, shallu (Guinea corn), and sunflower, since the factory intends not only to can vegetables and soups, but also to produce livestock feeds.

WINDWARD ISLANDS DOMINICA

Varieties

The vegetables most commonly grown are as follows:

- (a) Leaf and Stem Vegetables—cabbage, cauliflower, onion, shallot, spinach
- (b) Salad and Fruit Vegetables—celery, lettuce, tomato, eggplant, pepper, okra
- (c) Gourds and Pumpkins—cucumber, melon, pumpkin, christophine (chayote)
- (d) Root Vegetables—beet, carrot, turnip, radish

No information is available as to varieties.

Seed Supply

When required, seed is imported in small quantities from Canada and the United States and, in the case of cauliflower, India. There are no storage facilities other than airtight tins and jars, the cold storage available not being very reliable.

Organization of Production

Vegetables are produced on the outskirts of the capital, Roseau, in small whole time gardens of about $\frac{1}{2}$ to 1 acre each, and on peasant holdings.

Ecological Considerations

Sandy loams are the most satisfactory soil type. Best results have been obtained when seed is sown to ripen during the cooler months of the year, November to February.

Problems of Cultivation

Factors affecting cultivation are (i) water supply, (ii) supply of organic manure. To offset the latter, the establishment of compost heaps is being adopted.

Diseases and Pests

Chief pests and diseases of crops include the diamond-back moth, the white butterfly and aphids on cabbage and cauliflower, the flea beetle on eggplant, the chrysomelid beetle, lace wing bugs and leaf hoppers.

GRENADA

Varieties

Cabbage, cauliflower, lettuce, tomato, cucumber, melon, beet, carrot, turnip, mint, parsley and thyme are grown in insufficient quantities for local consumption. No onions are produced at the present time as, during the war, the source of seed supply, Teneriffe, was temporarily cut off.

No information is available as to varieties.

Seed Supply

Seed supply, other than onion seed, comes principally from the United States. The Department of Agriculture imports seeds for sale at regular intervals, and these are stored in desiccators with calcium chloride to insure viability. Certain growers import small supplies of seed, and there are four commercial houses which import seed at regular intervals.

Organization of Production

Production is on a very small scale.

Ecological Considerations

Vegetables can be grown practically anywhere if watered, but, at present, production is confined to areas where rainfall is about 80 inches and over.

Diseases and Pests

The chief diseases are (a) damping off of seedlings; (b) *fusarium* of tomatoes.

Relation of Production to Local Requirements

Production is inadequate. In pre-war days cabbages were imported from Canada. Onions have recently come in from South America.

ST. LUCIA

Varieties

<i>Type</i>	<i>Vegetable</i>	<i>Variety</i>
(a) Leaf and Stem Vegetables	Cabbage	Succession
	Onion	Yellow Bermuda
(b) Salad and Fruit Vegetables	Lettuce	Mignonette
	Tomato	Marglobe
	Celery	
	Okra	Six Weeks
(c) Gourds and Pumpkins	Pumpkin	Local Variety
	Cucumber	Improved Long Green
	Melon	Smith's Perfect
(d) Root Vegetables	Carrot	Chantenay
	Beet	Detroit Dark Red
	Turnip	Purple Top White Globe
	Radish	Red (Crimson) Giant
(e) Flavoring and Seasoning Herbs	Parsley	Extra Curled Dwarf

Seed Supply

The bulk of the imported seed is obtained by the Agricultural Department from W. Atlee Burpee Co., Florida.

Only short term storage in desiccators is necessary, as supplies are ordered regularly in small lots and sold to growers.

Cucumbers, melons, pumpkins and okra are the only seeds produced locally. They are produced by the growers themselves and reserved for the next planting.

Organization of Production

Vegetables are produced mainly by peasants in small gardens.

Ecological Considerations

With the exception of the tomato, which thrives best in the drier coastal areas, these crops grow on a variety of soil types and under varying rainfall conditions.

Diseases and Pests

There are no major problems affecting production. The more usual pests are fairly easily controlled. Mr. R. G. Fennah, Food Crops Pests Entomologist, has dealt fully with this in a report to be published shortly.

Relation of Production to Local Requirements

Production is inadequate for local needs. Large quantities of onions are imported from Canada, Argentine and Mexico.

Legislation

Ordinance No. 13 of 1930 (Amendment Ordinance No. 1 of 1933, No. 17 of 1933 and No. 3 of 1943) prohibits the export of certain fruits and vegetables.

Wartime Developments

Production declined owing to the migration of workers from their holdings to the United States.

ST. VINCENT

Varieties

Tomatoes, chiefly Marglobe, are the vegetables in which the most consistent interest is maintained by local producers. Lettuce is also in fairly regular supply by a limited number of growers—Mignonette and Big Boston being the most popular varieties. Okra (except during the cotton "close season"), cucumber, melon and pumpkin find their way to the local market in irregular and varied quantities in much the same manner as ground provisions. Cabbages are available periodically, and small quantities of beet, carrot, turnip, cauliflower and parsley are sometimes obtained locally. Shallot, mint and thyme are grown for a small but consistent home market.

Seed Supply

Seed supply of all the above listed vegetables, except okra, pumpkin, melon, shallot, mint and thyme, is imported, chiefly from the United States. The Department of Agriculture encourages the cultivation of green vegetables by importing seed for cultivators on request. Local commercial firms and individual producers also import supplies of planting seed. Local material for sowing vegetables is usually home grown. There are no commercial seedsmen or organizations for storage and distribution in the Colony.

Organization of Production

Production is unorganized and fluctuates with season and demand. The local market is supplied chiefly by small growers, whose market gardens are usually subsidiary to small scale agriculture. A few estate owners devote small areas to the production of green vegetables, but practically all the export trade, consisting mainly of tomatoes, is now in the hands of traffickers who buy from small market gardeners.

Ecological Considerations

The three main soil types of St. Vincent, viz. Yellow Earth, Alluvial and Recent Volcanic Ash, are all suitable for the production of vegetables. The limiting factor is climate rather than soil. Tomatoes, the only vegetable with export possibilities worth men-

tioning at present, must be grown in the drier part of the year, as fruit, stem and root rots affect production considerably. The best time for planting is towards the end of the rainy season: this permits the ripening of the crop in March-April (average rainfall 4.02-3.80 inches). The high rainfall district of the Marriacqua Valley, with its relatively good soil moisture content during the dry months, is considered to be one of the most suitable areas in St. Vincent for a truck farming industry. The soil is of the Yellow Earth (high level) type. Okra, pumpkin, melon and cucumber are relatively hardy vegetables, and are produced under the same general field conditions as ground provisions. They are sown with the rains in May (average rainfall 6.64 inches), except okra, which is planted in August or September when the "close season" has been lifted. The average rainfall for those months is 11.45 and 11.10 inches, respectively. Until recently, tomatoes were grown under irrigation, during the dry season, by one estate for export.

Problems of Cultivation

The problems of cultivation of the more delicate of the crops under review are many and varied. The changes in weather are such that, in the rainy season, downpours do as much to upset yields by causing various rots as prolonged periods of rainless days do in the dry season.

Diseases and Pests

Bubbly fruit rot and blossom end rot are the chief diseases attacking tomatoes. The former is largely the result of wet conditions and attacks the fruit from the stem, while the latter is carried in the seed supply, is only aggravated by weather, and attacks the base of the fruit where the blossom normally drops off. No control measures are practised. An unidentified wilt also causes considerable loss in local tomato cultivation.

Relation of Production to Local Requirements

Domestic production meets local requirements in all fresh vegetables. The supply is small. Only a certain section of the community is catered for, and this even in inadequate amounts. Small quantities of canned vegetables (e.g. beet, carrot, turnips) are imported by local firms each year, chiefly from the United Kingdom and the

United States. Marketing is haphazard and unorganized. Individual producers sell to hucksters or are themselves vendors, chiefly in the Kingstown public market, but also in door to door peddling. As stated above, there is really no surplus production, but some exporting is done, as better prices are usually obtainable overseas.

Numbers Engaged in Production

Vegetable production cannot be taken into great account as a means of employment. It is subsidiary even with respect to the limited number of market gardeners at present engaged in it.

Legislation

No legislation directly affects vegetable production and export, except the Cotton Protection Ordinance which provides for a "close season" for cotton and okra during which the production of these vegetables is forbidden by law. The period is proclaimed each year and usually lasts for about 3½ months (May 1 to August 15).

Research

No research work on production of vegetables was undertaken until the establishment of the Camden Park Experiment Station. Since that time, a model kitchen garden has been laid out, and detailed investigations into the possibilities of producing various types and kinds of vegetables under local conditions are being pursued. For a short period, between 1929 and 1935, an organization known as the Government Fruit and Vegetable Bureau was in operation in St. Vincent. It was set up with the object of developing trade, chiefly with Canada, and encouraged and catered to peasant production. But though shipments increased, overhead expenses and occasional losses made the maintenance of the Bureau uneconomic, and it was closed in June 1935. Tomatoes formed the chief vegetable export, but during the months of normal peak production (December-February), the St. Vincent material had to compete with shipments from the Bahamas in the Canadian market. As a result, an attempt was made to produce tomatoes for shipping in March-April. This necessitated the restriction of production to wetter areas, and resulted in the deterioration of the fruit. All this contributed to the failure of the Bureau.

Extension Service

One of the functions of the Agricultural Extension Service is the encouragement of vegetable production. Instructors arrange for the purchase of seed supplies for individual small growers through the Agricultural Department's Head Office. Advice on the setting out of seed beds, methods of cultivation and reaping are available on request, and the actual "hatching" of seedlings for distribution has been tried in the Windward District. There is, however, no specific program in relation to production of vegetables planned for the Extension Staff. Trial lots of seed are given to the more energetic and successful market gardeners when available.

Wartime Developments

The "grow more food" campaign probably had some slight effect in increasing production, and the limited section of the community accustomed to depend on canned imports of beet, carrot, etc., turned to local sources for their supplies.

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Cabbage: Bahamas, 1; Barbados, 3; British Guiana, 5; British Honduras, 13; Curaçao, 15; Jamaica, 23; Antigua, 31; Montserrat, 39; St. Kitts-Nevis, 45; Puerto Rico, 50; Surinam, 61; Trinidad, 63; Virgin Islands of the United States, 67; Dominica, 71; Grenada, 73; St. Lucia, 75; St. Vincent, 77.

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Indian Kale: British Guiana, 5; Jamaica, 23.

Kohl-Rabi: Bahamas, 1; Barbados, 3; British Guiana, 5; Curaçao, 15; Antigua, 31; Montserrat, 39; Trinidad and Tobago, 63.

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Shallot: Barbados, 3; British Guiana, 5; British Honduras, 13; Jamaica, 23; Antigua, 31; Montserrat, 39; St. Kitts-Nevis, 45; Trinidad and Tobago, 63; Dominica, 71; St. Vincent, 77.

Spinach: Bahamas, 1; Barbados, 3; Montserrat, 39; St. Kitts-Nevis, 45; Surinam, 61; Dominica, 71.

Swiss Chard: British Guiana, 5; Curaçao, 15.

Watercress: Montserrat, 39; Puerto Rico, 50.

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Celery: Bahamas, 1; Barbados, 3; British Guiana, 5; Curaçao, 15; Jamaica, 23; Surinam, 61; Trinidad and Tobago, 63; Dominica, 71; St. Lucia, 75.

Eggplant: Bahamas, 1; Barbados, 3; British Guiana, 5; British Honduras, 13; Curaçao, 15; Jamaica, 23; Antigua, 31; Montserrat, 39; St. Kitts-Nevis, 45; Puerto Rico, 50; Virgin Islands of the United States, 67; Dominica, 71.

Lettuce: Bahamas, 1; Barbados, 3; British Guiana, 5; British Honduras, 13; Curaçao, 15; Jamaica, 23; Antigua, 31; Montserrat, 39; St. Kitts-Nevis, 45; Puerto Rico, 50; Surinam, 61; Trinidad and Tobago, 63; Dominica, 71; Grenada, 73; St. Lucia, 75; St. Vincent, 77.

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Pumpkin: Barbados, 3; British Guiana, 5; British Honduras, 13; Jamaica, 23; Antigua, 31; Montserrat, 39; Puerto Rico, 50; Surinam, 61; Trinidad and Tobago, 63; Dominica, 71; St. Lucia, 75; St. Vincent, 77.

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