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PROCEEDINGS
OF THE
CARIBBEAN FOOD CROPS SOCIETY



FOURTH ANNUAL MEETING
KINGSTON , JAMAICA
JULY 25 -- AUGUST,1 1966

VOLUME IV

COUNTRY PAPERSRESEARCH IN FOOD CROPS - BARBADOS MINISTRY OF
AGRICULTURE AND FISHERIES

In July 1965 it was decided to reorganize the technical staff of the Ministry of Agriculture and to strengthen the section dealing with Research. The conventional research in agriculture in Barbados has since the inception of the Department centred around the improvement in sugar production. With the new policy of diversification in agriculture which has been expressed by Government and which is being attempted by farmers, it became obvious that the resources directed to Food Crops Research were inadequate.

In the new reorganization, the study of Food Crops was therefore divided into two sections with an agronomist in charge of each section. One agronomist is assigned to work on Vegetable Crops (market gardens) and Fruit, and the other agronomist to study Root Crops and Field Crops. In addition, it became clear that the study of pests and diseases must also be expanded by the provision of a plant pathologist and an additional entomologist. Furthermore, more intensive study is planned in the field of irrigation, mechanization, animal nutrition, dairy and livestock management, and artificial insemination.

The new staff structure attempts to provide the personnel to tackle this job. However, the difficulty in recruiting staff seriously affected the start of the programme and even now the staff structure has not been satisfied. However, a start has been made with the resources available, and the programme of field investigations on root crops and vegetables was in progress by late 1965. Many of the trials started are unsophisticated and in the nature of observation plots. As the studies progress it is obvious that the information sought will be more precise and the techniques more refined. The extension and scope of this programme in food crops research is discussed herein.

A. Research Programme - Vegetable Crops and Fruits

At the moment trials are being conducted on the following Vegetable Crops:

Tomatoes: The variety 'Bounty' which is the most popular variety here is offered for sale by several seed houses. A simple trial is being done to test the claim that there is difference in performance in the 'Bounty' seed from two different seed houses.

At Bullens Research Station preliminary trials were carried out on "Bird damage Control in Tomatoes" using perforated polythene tubing. It appears as though the use of tubing as a control is feasible and further work with this material will be carried out. Further trials will involve variety testing under plastic, with insect and fungal control.

Trials will be carried out with varieties of tomato seeds, obtained from R.R.C. Trinidad. These will include the following varieties - Anahu, Indian River, Floralou, Manapal, Sunray, Nema Red, Tecumshe, FR 112(199) 63-62, Urbara, Success.

Carrots: Work on carrots will centre around the two varieties Danvers Half Long and Nantes. At the moment there is a spacing trial at Sayes Court Research Station.

There are two weedicide trials using Dacthal, Amiben Liquid, Amiben Solid, Linuron and Kerosene Oil.

The long rooted carrot varieties are reported to suffer severely from rot during the wet season, hence the use of Oxheart during this period. During the present wet season attempts will be made to overcome the incidence of rot by raising beds or deepening furrows.

Cucumbers: At the moment there are two variety trials, one at Sayes Court and the other at Bullens. Since there are only three varieties available namely Ashley, Marketer and a local variety, these are the only ones in the trials but work on other varieties will be started soon.

Beets: Work on beets will be centred around fertilizer trials.

Radish: It is felt that this crop which is of very short duration 28-30 days should find a ready market particularly among the hoteliers. Initial work on two varieties of radishes will aim at establishing that Radishes can be grown successfully and economically here.

Beans: Varietal testing will be carried out shortly. Two varieties namely Harvester and Extender will be tested shortly at Bullens Station.

Onions: Trials on onions have got underway to determine whether the crop can be grown successfully. There are two plots at Sayes Court and Bullens. Later varietal trials, spacing trials and fertilizer trials will be done.

Cabbages: There is a trial at Bullens at the moment with a view to investigating the Black-rot problem. Further work on this aspect will involve different varieties.

Other Vegetables: Some work will be done later on Shallots, Cauliflower, Canteloupe and Pumpkins.

FRUIT CROPS

Bananas: There is one plot at Bullens and another at Jerusalem, maintained primarily to supply planting material but yields of fruit are being recorded.

Pineapples: There is a small observation plot at Bullens (mainly Smooth Cayenne). It is hoped to extend this work to additional varieties and to pursue variety testing and fertilizer trials.

Pawpaws: There is considerable interest in pawpaws both for local use and export and some varietal testing is underway at Sayes Court.

B. Research Programme - Root and Field Crops

Work is planned for the following crops: Okras, Sweet Potatoes, Yams, Peanuts, Irish Potatoes.

Okras: Work on this crop this year will be as follows:

(a) Variety testing and identification

Varieties to be tested are:

- (i) Clemson Spineless
 - (ii) Perkins - Long green pod
 - (iii) Dwarf - Green long pod
 - (iv) Lady fingers
 - (v) Six weeks
 - (vi) Governor's Gut
- } Local varieties

These will be set out in a randomized block experiment. The following records will be made:

- (i) Germination percent and number of days to germination for each plot.
- (ii) Age at first flower.
- (iii) Vigour at first flower.
- (iv) Botanical description of each variety:
This includes:
 - (a) size, shape, length and average weight of each pod;
 - (b) shape and size of leaf;
 - (c) height and bushy appearance of plant;
 - (d) colour;
 - (e) presence or absence of spines;
 - (f) Any other observations.

(v) Duration of bearing of each variety

This variety testing will be combined with the rejuvenation of second bearing. Here the crop will be cut back and allowed to grow and bear again.

(b) Plant Population - Using only Clemson Spineless variety - slim and slender in appearance, population studies will be made ranging from 5,445 plants per acre to 24,891 per acre. Using the Bushy type variety - Perkins - a similar study will be made. Yields, weed population, and ground cover will be recorded in both instances.

(c) Irrigation - A comparison of yields will be made between irrigated and non-irrigated plots. This study will be combined with the study of costs of production, and weed control.

Sweet Potatoes: Work on this crop will be mainly variety testing and population studies. Some ten local varieties, five from Trinidad and some from Puerto Rico will be tried. These will be observed and tested for yield, quality, shape, size, storage and consumer preference, and resistance to scarabee attack.

Yams: Work on this crop will be in two phases:

Phase I.

Work on the incidence of internal spotting: (a) Field Trials; (b) 'Pot Culture' Trials.

(a) Field Trials - Some trials are being done on some fifteen plantations distributed in all rainfall areas and soil types, and selected according to the incidence of the spotting.

(b) 'Pot Cultures' will be done with three different soil types. Four trace element treatments will be used:

1. Boron as Borax
2. Manganese and manganese sulphate
3. Magnesium as magnesium sulphate
4. Copper as copper sulphate

Phase II.

Variety testing and plant population studies using White Lisbon, Oriental, and Coconut Lisbon varieties will be carried out.

Peanuts: Studies will include:

- (1) Cost of production
- (2) Variety - a) Local
b) Bunch type variety
- (3) Cultivation - a) Flat
b) On 2' and 3' ridges
- (4) Spacing from 4" to 15"
- (5) Possibility of mechanical harvesting
- (6) Nutrition work

Irish Potatoes: This work will include two phases:

- (1) Variety testing : Merrinac, Kenembec, Kathadin,
Sebago, Red La Sota, plus 25
varieties from the U.W.I.
- (2) Cultivation Trials: a) Flat planting
b) Ridge planting at 30" - 50"
c) Spacing at 6" - 18"

Some studies will also be done on time of planting.

* * *

RESEARCH IN FOOD CROPS - BARBADOS SUGAR PRODUCER'S
ASSOCIATION

The Barbados Sugar Producers' Association set up an Agronomy Research Unit in February 1965, including a section devoted to Crop Diversification. Among the tasks of this section was research on food crops. A working agreement was reached with the Ministry of Agriculture and Fisheries to avoid duplication of effort, and it was decided to concentrate mainly on the plantation crops of yams, sweet potatoes and corn, along with some work on English potatoes and onions.

Research Programme

In the first year (1965-66) plots of approximately one acre were planted in each of six localities representing six different soil types and rainfall areas. The main trials were on density of planting: it was found that, in general, much higher densities per acre could be carried than were normally planted, though the optimum density giving the maximum yield of "saleable" material varied with the ecological conditions of the locality. Tentative conclusions on optimum plant density were as follows:

Yams	-	3,440	per acre	(cultivar Crop Lisbon)
Sweet potatoes	-	8 - 10,000	" "	" " B 62 - 07)
Corn	-	14 - 25,000	" "	(Local Barbados variety)
English potatoes	-	17,500	" "	(Patrones and Red La Soda)

Under the best conditions the following yields obtained:

Yams	-	34,500	lbs/acre
Sweet potatoes	-	18,300	lbs/acre
Corn	-	6,850	lbs/acre (freshly harvested, on the cob)
English potatoes	-	16,270	lbs/acre (with irrigation)

A corn varietal trial compared 14 cultivars from Colombia with the standard Barbados type. Two Colombian cultivars appeared promising. Growth analyses were carried out on Sweet potatoes (cultivar Caroline Lee) and on Yams (Crop Lisbon).

One planting of onions demonstrated that varieties Texas Grano 502 and Crystal Wax could be expected to do well under irrigated conditions.

The current years experiments (1966-67) are mainly following up those of the previous year, but on a very much more extensive scale: some 95 acres on 15 plantations.

- | | | |
|-----------------|-----|---|
| Yams: | (a) | comparison of two varieties at two spacings; |
| | (b) | comparison of 0 and two levels of fertilizer; |
| | (c) | comparison of planting material - top, middle and bottom cuttings, and "seed" yams; |
| | (d) | growth rates of four cultivars; |
| | (e) | effect of wind on leaf disease. |
| Sweet potatoes: | (a) | comparison of two spacings on one cultivar; |
| | (b) | comparison of 0 and two levels of fertilizer. |
| Corn: | (a) | Comparison of three spacings; |
| | (b) | comparison of 0 and two levels of fertilizer; |
| | (c) | selection from high yielding plants; |

Corn...

- (d) comparison of 17 cultivars from Trinidad, Mexico and Jamaica with the "standard" Barbados type;
- (e) Herbicide trial.

English potatoes:

- (a) comparison of 12 cultivars from Holland, Canada and the U. S. A.;
- (b) late planting experiment - assessment of the performance of 4 cultivars planted between April and June;
- (c) time of planting; two cultivars planted at 6 - 8 weekly intervals from mid-September 1966 until June 1967, in three localities, one being irrigated.

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OUTLINE OF RESEARCH IN FOOD CROPS - GUYANA

Compiled by C. P. Kennard
Principal Agricultural Officer (Research)

FRUIT CROPS

Banana (Musa acuminata)

Trials are being carried out with Shell and Esso banana spray oils and with Anthracol and Dithane M - 45 for control of Cercospora leafspot.

Ashew (Anacardium occidentale)

The performance of some local selections and a number of introduced varieties are being investigated.

Citrus (Citrus spp.)

The research work being done on citrus includes trials with rootstock which are resistant or tolerant of tristeza, xyloporosis and exocortis; testing of budwoods for the presence of tristeza, xyloporosis and exocortis; fertilizer trials, and testing of insecticides for control of aphids (Toxoptera spp.) and scales

Coconut (Cocos nucifera L.)

Practically all the coconuts in the country are being grown in the narrow coastal strip on the frontland clay and sandy soils. In view of the shortage of edible oil in the country and the need for expansion of the coconut cultivation, investigations are being carried out on the growing of the crop on other soil types. Fertilizer trials are being carried out on different soil types and the biology and control of the pests, Brassolis apphorae L., Castnia daedalus and Strategus aloeus are being investigated.

Pineapple (Ananas comosus)

Very little research is being done on this crop at present but varietal and fertilizer studies on different soil types are to be undertaken.

SPICES

Practically no research work is at present being done on the spices, but investigations with crops such as tumeric, ginger, black pepper, and coriander are to be initiated shortly.

ROOT CROPS

The root crops, eddoes (Colocasia esculenta), tannias (Xanthosoma spp.) yams (Dioscorea spp.), and cassavas (Manihot utilissima) are grown mainly as a catch crop in Guyana and very little if any research is done on these crops. Varietal and fertilizer studies are being undertaken with the sweet potato (Ipomea batatas) on the brown sands.

PULSES

The pulses which are receiving some attention at present are peanuts (Arachis hypogaea), pigeon pea (Cajanus cajan), soya bean (Glycine max.), mung (Phaseolus aureus) and black eye (Vigna sinensis). The research on these crops includes varietal, spacing, and fertilizer studies.

VEGETABLES

Varietal and fertilizer studies are being carried out with cabbages (Brassica oleracea), tomatoes (Lycopersicon esculentum) and onions (Allium cepa). The control of the major economic pests and diseases of these crops are also being investigated.

CEREALS

Rice (Oryzae sativa)

Rice, because of its importance in the economy of the country is the crop on which most research is done. The research on this crop includes breeding of medium and long grain varieties with the following characteristics:

1. Period of maturity about 100-140 days.
2. Non-lodging, and fertilizer responsive.
3. Blast resistant.
4. High yielding.
5. High milling, recovery and low breakage.
6. Moderately firm threshability.
7. The seed should possess a period of dormancy.
8. Moderate tillering with moderate number of leaves per tiller, leaves narrow and stiff, type suited to direct seeding (as opposed to transplanting).

Agronomic investigations are being undertaken to determine the yield potential of imported varieties, and with herbicides and fertilizers. Pathological and Entomological investigations are being carried out with seed treatment, fungicides for the control of blast disease (Piricularia oryzae (Cav.) and in the biology and control of Oebalus poecilus (Dall.), Helodytes foveolatus (Duval) and the stem borers, Rupels albinella (Cr.) and Diatraea saccharalis (F.)

Corn (Zea mays)

The research work to date on corn has been confined to fertilizer and spacing studies with local varieties. The first step towards producing a synthetic variety has now been taken by the testing of mass selected types. The performance of a number of imported varieties is investigated.

Sorghum (Sorghum spp.)

The performance of a number of introduced varieties is now being investigated.

OUTLINE OF FOOD CROP RESEARCH PROGRAMME OF IFAC
IN THE FRENCH ANTILLES

Main Crops - Bananas and Pineapples

BANANA RESEARCH

1. Plant Improvement

Selection of clones adapted to conditions on local farms based on:

productivity
quality
resistance to pests and diseases

2. Studies of Plant Behaviour and needs in response to environment

Biometri studies
Studies on actual needs of the plant
Quality problems (finger drop in bananas)

A preliminary series of studies designated soil/plant trials - the results of which are now in course of publication - has already provided much information on physiological variations shown by the banana plant and on variations in its mineral status at different stages of the production cycle.

This information has provided a useful basis for a new programme of research.

The problem of fruit quality and in particular the problem of "finger drop" persists as a major preoccupation of IFAC in the French West Indies.

Studies which are being developed include changes in the stages of mineral nitrogen (NO_3 & NH_4) in soils and studies on Banana Morphology; particular techniques for the application of organic manures are also being studied.

A Biochemical section recently added to the laboratory in Martinique is undertaking research on the organic constituents of the banana plant and modification in response to ecological conditions.

3. Cultivation Techniques

density and method of planting
mechanization
plantation management

4. Pest and Disease Control

(a) Root System studies

1. nematodes: (a) study of nematode populations and analyses of samples in the Martinique laboratory of IFAC.

(b) Agronomical Studies

2. Banana Borer: Parallel tests in field and laboratory on Borer tolerance to insecticides with a view to clarification of the phenomenon of resistance development.
3. Fungi: Study of the fungal fauna of banana fruit bunches, isolation and identification of organisms responsible for destruction of the root systems and testing of specific fungicides for control.

- (c) Leaf System: Cercospora is no longer a difficult problem owing to oil treatments and the development of methods for anticipating heavy attacks.

Defoliating insects are a special problem in Guadeloupe (Phyllophaga) and are being studied.

- (d) Harvesting: Trials for the control of thrips and *Deightoniella torulosa* both of which affect the fruit are in progress.

- (e) Virus diseases: The development of mosaic disease is being closely watched. Several different organisms have been isolated and studies on weed inoculations are in progress.

- (f) Weed Control Herbicides: The Plant Pharmacology Division based on Guadeloupe undertakes regularly, herbicide tests to study the action of new products not only from the point of view of efficiency against weeds but also as regards phytotoxicity to banana plants and residual activity. Micro tests and field trials are employed.

5. Fruit studies

1. Quality: Fruit treatments - Phytosanitary tests
Criteria for assessing susceptibility to Finger Drop. Practical application of a new technique for estimating susceptibility of a banana crop based on a simple morphological criteria but on susceptibility to finger drop and rotting - "The Gleosporium test" is a simple technique based on observation of the

behaviour of fruit after inoculation with a specific fungus - *Gleosporium musarum*

2. Packaging: Studies of packaging materials, methods of packaging and packing plants. Establishment of standards for packing fruit for external markets.

3. Transport: Fruit and package behaviour under conditions of sea transport. Equipment of banana transport boats and functioning of their refrigeration installations.

4. Technology: Food processing - use of surplus supplies.

IFAC RESEARCH ON PINEAPPLES

1. Plant Improvement

Efforts to produce a hybrid with most of the characteristics of the Smooth Cayenne but with a firmer flesh and displaying the disease and pest resistance of the Red Spanish or Perolera varieties.

2. Reaction of the plant to environment

Study of plant/environment relations is aimed at establishing the optimal characteristics of the main types of planting material. The idea here is to secure the maximum yield at minimum cost and to determine the most appropriate times for application of treatments for inducing flowering.

3. Nutrition

The aim here is to secure precise information on the needs of the plant throughout the period of its life cycle. Research on basic needs will be undertaken in hydroponic culture jointly with field trials in the main producing areas of Martinique. A special aspect of this study will be the interaction of the several cations. Fruit intended for processing will be treated separately from fruit intended for the fresh fruit market.

4. Control of Flowering

The aim is to secure complete mastery of the flowering process by appropriate hormone treatments. Apart from field trials the effect of different environmental factors on the response of the plants to different products tested (viz SNA, BOH, acetylene, ethylene) will be evaluated - laboratory studies will be made of the changes in auxin content of the terminal meristems of the plants in response to different climatic factors and changes in the content of the main nutritional elements.

5. Cultivation Techniques:

Studies in this area include:

plant population density
method of planting - flat or on raised beds
use of polyethylene covering and the effect
of transparency of the material on soil
temperature.

6. Pest and Disease Control:

Root parasites: Testing to determine the most effective products for controlling the main root pests encountered in Martinique and Guadeloupe; nematodes (mainly *Rotylenchus reniformis*) and symphilides (mainly *scutigelia immaculata*).

Phytophthora Rot: Many products are under test. Difolatan gives good results and is now extensively used.

Herbicides: Each year with the appearance of a new product new trials are made. Studies are made of the action of the product on weeds and on the pineapple plant itself including application between the rows only and general application in which the plant itself is also exposed to the herbicide.

7. Fruit treatments:

Under this heading we include mainly studies aimed at retarding fruit maturity and increasing yields by application of hormones after fruit differentiation has taken place. Up to the present efforts in this direction have resulted in lowering the quality of the fruit.

8. Packaging of Pineapples for export as fresh fruit:

The aim here is to lower the recurrent cost of packaging especially for small sized fruit which one is tempted to withhold from the market. A number of models offered by european factories are being tested.

9. Mechanization: The aim here is to lower the recurrent cost of hand labour as a charge against income. One machine under trial is capable of performing the following tasks:

- (a) planting on beds
- (b) application of two bands of fertilizer alongside the rows for planting pineapples
- (c) continuous application of nematocide behind two furrowing tynes
- (d) laying down of polyethylene strip and lateral covering of the strip with earth.

Efforts are also being made to adapt the "Boom sprayer" for use under local conditions as well as harvesting machines being used in other countries. Finally methods of transport and handling best suited for use with pineapples intended for export as fresh fruit are being tested - grading by weight seems most likely to be acceptable.

AVOCADOES

Research on this crop is directed mainly at determining the varieties most adapted to the micro-climates of Guadeloupe and Martinique.

The putting into practice of the best cultivation techniques and research on the most economical methods of packaging are also receiving special attention.

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FOOD CROP RESEARCH - JAMAICA MINISTRY OF AGRICULTURE AND LANDS

Division and Officers involved with Research on Food Crop Research

Chief Technical Officer	W. G. Stuart
Department of Crops and Soils	
Director	J. H. Haughton
Chief Agricultural Officer	W. K. Mitchell
Crop Agronomy Division	
Chief Agronomist and Cacao Specialist	B. F. Topper
Corn Specialist	E. R. H. Martin
Coffee Specialist	R. I. Moss
Citrus Specialist	L. A. Bell
Food Crops Specialist	D. H. Stone
Soft Fruits Specialist	Mrs. M. R. Davidson
Vegetable Specialist	J. H. Donaldson
Miscellaneous Fruit Crops Specialist	S. K. Glasgow (on secondment)
Herbicides Specialist	C. A. Frankling

Agricultural Chemistry Division
 Agricultural Chemist
 Agricultural Officers

C. W. Hewitt
 Mrs. K. Richardson
 C. A. Lewis
 O. V. Simpson
 R. S. Baker

Plant Protection Division

Chief Plant Protection Officer
 Nematology and Entomology
 Pathology
 Entomology
 Lethal Yellosing - Disease of Coconuts

A. G. Naylor
 W. Dixon
 D. Hastings
 R. Tewari
 T. G. Grant
 N. E. Grylls

Department of Agricultural Economics
 Director

I. E. Johnson

Main Avenues of Food Crop Research currently being undertaken

Corn

Corn breeding for Jamaican conditions - Hybrids
 Controlled mass selection
 Top Crosses
 Composites and synthetics

Variety testing
 Spacing trials

Food Crops

Irish Potatoes - Area testing for summer production, variety testing, disease control (with Plant Protection Division).
 Yams - Propagation studies, chemical weed control, spacing, development of rare varieties.
 Sweet Potato - Variety testing
 Plantains - Clonal selection
 Legumes:
 Red Kidney beans - Planting methods
 Pigeon peas - Disease control
 Peanuts - Variety testing

Vegetables

Variety introduction and testing
 Time of planting
 Weed Control
 Mechanization

Vegetables...

Disease and pest control

Nutrition

Main Crops

- Tomatoes

Onions

Sweet Corn

Carrots

Okras

Pumpkins

Cucumbers

Water melons and other melons

Minor Observations

- Papaws

Soft Fruits

Introduction, testing of non-tropical and high value fruits and nuts.

Strawberry, raspberry, peach, lyches loquat grapes, figs, passion fruit, asparagus, apples, pears, nectarines, plums, cherries, macadamia, cherimoya, sweet sop, naseberry.

Tree Crops

Pimento (major activity)

Ackee

Avocado Pears

Guava

W. I. Cherry

Orchard establishment, variety testing.

Agricultural Chemistry Division

Nutrition experiments on various food crops and vegetables.

Pimento leaf analysis

Total chemical analysis of Jamaican soils

Minor element status of citrus

Plant Protection Division

Nematode survey and control

Pimento rust disease control

Papaw bunchy top disease control

Disease of Legumes

Blight on Tomato

Blossom end rot of melons.

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Research Staff

Director of Research - D.H. Romney, B.Sc. (Reading)
 (Hons. Ag. Chem.), A.R.I.C.
 Agronomist/Crop Physiologist- R.W. Smith, B.Sc. (Wales)
 (Hons. Bot. with Ag.Bot.)
 Botanist/Plant Breeder - R.A. Whitehead, B.Sc. (Durham)
 (Hons. Bot.), Ph.D. (U.W.I.),
 M.I. Biol.

Agronomy/Crop Physiology (R. W. Smith)

Field Trials:

Growth
 Planting methods
 Fertilizer testing
 Tillage, mulch, inter-cropping
 Herbicides
 Spacing
 Rat Control
 Cattle repellants
 Orchard oils

Chemistry (D. H. Romney)

1. Develop method of moisture determination
2. Distribution of moisture in different parts of endosperm and copra, and effect of stage of maturity and variety
3. Effect of % R. H. on moisture in copra.
4. Develop methods of oil determination in copra and sesame seed.
5. Assess variation in oil content of copra with sample size.
6. Regular oil determination on copra from agronomy and botany expts.
7. Develop methods of analysis of fronds for N, P, K, Na, Mg.
8. Assess variation in frond nutrient content with sample size.
9. Regular nutrient logging in agronomy and botany expts.
10. Develop small scale copra drier.

Botany/Plant Breeding (R. A. Whitehead)

Varietal characteristics
 Pollination studies
 Germination
 Haploidy
 Resistance to Lethal Yellowing disease

Effect of hormones on fruit
 Controlled pollination
 Seed and pollen introduction
 Nursery management
 Introduction and testing varieties

Oil Palm Investigations

Pollen storage
 Introduction of varieties

Botanical Studies of Sesame

Field trials

BANANA RESEARCH

Research Staff

Director	Dr. J. R. Sessing
Senior Agronomist	L. A. Walker
Agronomist W.D.	E. G. Lee Hew
Agronomist N.D.	D. C. Stanford
Crop Physiologist	Dr. L. B. Coke
Chief Analyst	Mrs. D. E. Boland

Investigations are categorized as follows:

- A. Disease Pest and Disorder
- B. Nutrition
- C. Field Management
- D. Varietal Comparisons

Projects by categories

- A. Disease Pest and Disorder
 - I. Fruit and stalk rot investigations
 - (a) Post harvest fruit sanitation
 - (b) Transport and storage techniques
 - (c) Control of storage rots
 - (d) Varietal comparisons
 - (e) Altitude and seasonal susceptibility to pathogens

II. Sigatoka disease control

- (a) Oil-water emulsions
- (b) Assessment of applications
- (c) Oil and emulsion spray injuries
- (d) Oil and fungicide comparison trials

III. Nematode control

- (a) Nematode observation plots
- (b) Nemagon vs. hot water treatment
- (c) Nemagon granule studies
- (d) Comparative soil fumigant studies

IV. Thrips control**B. Nutrition****I. Major elements**

- (a) Poultry manure studies
- (b) Time effectiveness of NPK applications
- (c) Cement dust as potash supplement
- (d) Nitrogen and fruit quality

II. Minor elements

- (a) Micro-nutrient effect on plant growth and fruit quality
- (b) SM-3 experiments
- (c) Laboratory analyses

C. Field Management**I. Spacing trials**

- (a) Effect of population on growth, yield and fruit quality
- (b) Effect of altitude on density
- (c) Banana/coconut spacing trial
- (d) Population and rate of fertilizer application

II. Soil water relations

- (a) Effect on "jumping out of heart"
- (b) Effect on growth and yield

III. Weed control

- (a) Economic studies
- (b) Screening of herbicides

IV. Demonstration plots

V. Advisory

- (a) Chemical weed control
- (b) Pruning and crop succession
- (c) Soil testing, fertilizer use and amendments

VI. Miscellaneous

- (a) Borer control studies
- (b) Liming trials - Cement dust vs. burnt lime
- (c) Germination studies with clean seed

D. Varietal Comparisons

I. Cabendish varieties

II. Breeding Scheme varieties

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FOOD CROPS RESEARCH - JAMAICA

TWICKENHAM PARK PILOT VEGETABLE PROJECT

J. H. Donaldson

ABSTRACT

This paper relates to the circumstances prior to and actions relevant to the establishment of a Vegetable Research Project on some 40 acres of land towards the development of a viable vegetable production industry. The difficulties, problems and obstacles encountered, particularly with the greater mechanization and use of herbicides are discussed briefly.

RESEARCH ACTIVITIES

Emphasis has been directed towards the production problems of sweet corn, tomatoes, carrots, and onions, pigeon peas, kidney beans, pumpkins, melons, okra and pepper. Labour requirements and costing records are kept.

The information gained from the researches so far is summarized in the following Fact Sheets.

List of Fact Sheets

- No. 1 - Sweet Corn at Twickenham Park
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1964 - Spring 1965
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hyalinata)
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Park
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CROPS

(a) Sweet Corn (F.S. 1)

Most of the work has been done with two open pollinated varieties, USDA 34 and Dorado 50. Seed is produced locally and the strain maintained by mass selection. Grading of seed is essential to ensure uniformity for mechanical planting, and one of the problems was to find small equipment to do this. Special John Deere planting equipment has been found satisfactory the equipment being also capable of side-dressing the rows with fertilizer. The quality of these varieties when processed differs from the standard of the imported product and difficulties have been experienced in reaping a uniformly developed cob. Losses resulting from reaping at wrong maturity are heavy. It has therefore been considered desirable to screen hybrid varieties with the aim of producing a more uniform product and achieving more precision in harvesting dates. This work is proceeding, but none of the varieties tested so far show fully satisfactory vigour or the high yield potential of the area for which they were bred.

Varieties which show promise are:

F. M. Crass
Trowells Evergreen
Tunget 2125E
Golden Cross
Bantan
Florigold 106A

Many of the problems of sweet corn centre around marketing and post-harvest handling of the crop. Packaging the crop has so far been done under adverse conditions. Research in these fields is planned as soon as suitable facilities can be provided.

Field behaviour of the crop indicates nutritional deficiencies occurring in certain areas of the field. The symptoms suggest zinc deficiency but soil and foliar applications of zinc have not been entirely satisfactory in correcting the trouble. Further research, including green house pot tests is planned as soon as facilities are available.

Yields have been moderate: 800 to 1,000 dozen marketable ears per acre is a fair average for the 'local' varieties. Hybrids so far have yielded smaller crops.

(b) Tomatoes (F.S.2)

Work with tomatoes has been concerned mainly with variety observation trials, cultural methods, pests, diseases and weed control.

Florida varieties have been adopted as standard, e.g. Manalucie and Indian River. These have tended to be late and indeterminate bearers. Trials with other varieties indicate that there are some more adaptable to this climate and it is possible that Florida varieties will be superseded by other types.

Direct seeding techniques have been adopted and after a number of trials with trellising it was concluded that allowing the plant to grow and fruit on the ground unpruned, was the most practical method of husbandry. Preliminary trials with artificial mulch did not suggest superior advantages, one reason being mulches appeared to encourage a rodent pest problem, and investigations on these lines have not been pursued.

Considerable success was achieved in disease and weed control. Insect pests and nematodes have also been successfully controlled.

Side and overall dressings of mixed fertilizer of 500 up to 1,000 pounds per acre have been used to date; response to differing rates of fertilizers has not been conspicuously marked.

(c) Onions (F.S. 10)

The onion has been found to offer the greatest number of problems and has received the most intensive cultural investigations to date. The principal problems have been (a) Establishment of a properly germinated planting, (b) Determination of varietal response to planting date, (c) Chemical weed control, (d) Nutrition, (e) Irrigation requirements, (f) pest control, (g) tip burn and leaf disease control, (h) production and storage of sets, (i) Mechanical cultivation.

Although considerable progress has been made in these endeavours more facts have to be established before a routine can be adopted for commercial production of onions at Twickenham Park. The achievements to date are - the technique of establishing a good stand of seedlings by direct seeding has been mastered, promising methods of chemical and mechanical weed control have been tested, thrips have been controlled and a pattern of varietal behaviour in response to day length is emerging. Factors which require more emphasis in further investigations include the general growth response to cultivation, weed control, nutrition and irrigation, tip burn control and variety characteristics. The production and use of sets as planting material will be subject to further investigation. Production of and use of sets as planting material has not so far been as satisfactory as was hoped.

(d) Carrots

Yield and quality of carrots have been poor (the average being less than 3 tons per acre). Danvers 126 was selected as the standard variety. This is a relatively short variety suitable for processing, but commonly consumed in Jamaica as a fresh vegetable. Trials were conducted with other varieties including the table varieties of Nantes and Imperator. None have so far exceeded the yield of Danvers 126. Observations of the performance of carrots in several localities suggest that the varieties at present being planted are not suited to the climate and soil of the site of Twickenham Park which is practically on sea level. It is possible that this is due to variation of soil and air temperatures not falling within the range requisite for the development of carbohydrate storage; for although the foliage development is apparently satisfactory, only relatively few individual plants develop respectable sized good quality carrots. It may be possible that by means of selection strains might be developed adapted to the environment, or a variety more amenable to the conditions found; until then, carrots do not appear a favourable commercial crop for Twickenham Park conditions.

Investigation on carrots has not been devoid of yielding information; control of diseases and nematodes as well as weed control have been investigated with fair results.

(e) Cucurbits

1. Investigations on pumpkins have consisted of preliminary investigations on the possibility of selecting types of local varieties which would continue to reproduce true to type consistently. The local varieties of pumpkins are so variable in size and quality that uniformity should be established before comparative trials can be conducted. A Cuban variety has been grown successfully and apparently is a higher yielder with a longer productive reaping period than any local variety grown so far. It has also maintained a high degree of uniformity. Tests have been conducted on its processing characteristics which were acceptable, but it has not achieved full acceptance on the local market.

2. Slicing Cucumbers (Variety Ashley) have been grown successfully. No major problems were encountered, other than weed control. (F.S. 7).

3. Water melons (Charleston Gray), have grown moderately satisfactorily but were susceptible to blossom end rot. Trials have been conducted to determine whether variations in nutrition can affect the incidence but negative results have been obtained. Other varieties including Sugar Baby were found very resistant to the condition, and satisfactory in yield. (F.S. 5).

4. Small scale observations of other types of melon including Cantaloupes or Musk Melon indicate that there are varieties which are suited to Twickenham Park and which are capable of being produced in early winter months. Should the results be confirmed the possibilities of an export trade should be investigated.

5. Okra: This crop (Variety Emerald), has been grown and proved a moderately remunerative, but labour consuming crop. (F.S. 8)

6. Other Crops: Observations are being conducted on varieties of lettuce, sweet peppers, hot peppers, spinach, string beans and kidney beans.

Preliminary plantings have been made of pigeon peas to observe the effect of date planting on growth and flowering.

A small plot of papaws of a variety which may possess resistance to virus disease has been maintained.

CONTROL OF PESTS

Sweet Corn (F.S. 1)

The susceptibility of sweet corn to *Laphygma* caterpillars necessitated intensive investigation. The problem has been solved to date by the use of weekly high volume applications of D.D.T. by means of a special boom sprayer serving only two rows at a time. Spacing is calibrated exactly over the rows so that the liquid can reach the heart of the leaf whorl where the caterpillar feeds. Low volume application of Sevin by means of a mist blower controls the *Laphygma* and ear worm attached to the cob.

Tomatoes (F.S. 2)

Insect attack has not on the whole been a major problem with tomatoes. Inclusion of Malation or Sevin in sprays applied for control of leaf diseases may be credited with adequate control of leaf miners and caterpillars. Occasionally, fruit have been affected by the caterpillars of the tomato fruit worm (*Chloridea obsoleta*) but this was at the end of crop after spraying had been discontinued.

Onions (F.S. 10)

The onion thrip has been severe and at one time was thought to be a major factor influencing tip-burn, but although control of thrips has been established by several insecticides tip-burn has not been significantly reduced.

Cucurbits (F.S. 3)

Spot spraying of initial outbreaks of melon worm, *Diaphania hyalinata*, has been controlled by standard insecticides, D.D.T., Malathion, Sevin or Diptrex.

Nematodes (F.S. 4)

Observations on the character and fluctuations of the nematode fauna have been conducted from the commencement of the project; so far although rapid build up of populations of root knot nematodes have been recorded, control by fumigation with a pre-planting nematocide (D.D.) has been found satisfactory for a period of 12 months. It has also been demonstrated that dry fallow between crops by successive disc harrowing has considerable effect on reducing parasitic nematode infestation.

Soil Insects

Beetle grubs, cut worms, caterpillars and crickets have been occasionally destructive, but not excessively so. Dieldrin applied as a spray, to the soil prior to planting, has kept most attacks under control.

Rodents

Field mice became a major problem in tomatoes particularly when mulch trials were being undertaken. Nibbling indiscriminately spoiled much fruit for the fresh market. No control measures were undertaken.

Birds

The recently naturalized cattle egret are frequently engaged in large numbers in seeking insects throughout the plantation, particularly when mechanical cultivation is being undertaken. No estimate has been attempted of the role these birds play in the control of insect pests, but it may be quite substantial.

PLANT DISEASES

The open pollinated varieties of sweet corn have not suffered significantly from plant disease, but some of the varieties of hybrids being screened have shown susceptibility to rust and to virus diseases.

Early blight of tomatoes caused by Alternaria solani has been a major problem (F.S. 6). Adequate control by copper based fungicide was not obtained but trials with Manganese - zinc formulations - proved greatly superior, and the use of Dithane M.45 or Manzate D is now standard practice. Tomatoes have also been subject to late blight (Phytothora infestans), Root Rot, Scelerotium rolfsii but not on a serious scale. Similarly, blossom-end rot and uneven ripening, the causes of which are still subject to question, have occurred but not significantly.

Leaf blights caused by species of Alternatia have affected carrots as well as onions. Spraying on a weekly cycle with manganese-zinc formulation have given satisfactory control, as in the case of tomatoes.

Carrots have been badly affected by root disease, caused by Scelerotium rolfsil, etc., especially the crops planted immediately after initial land clearing of sugar cane and while incompletely rotted cane residues were still in the soil. The incidence of root diseases in carrots and in tomatoes has decline as time went on. The inference to be drawn is that

trouble with root diseases may be expected in the early months of a shift in a rotation from cane to carrots.

Blossom-end rot of water melons (F.S. 5) has been investigated with inconclusive results. The use of calcium sprays as recommended elsewhere has proved ineffective as were treatments involving gypsum, superphosphate and dressings of organic matter. Considerable variation in varietal susceptibility has been recorded, the standard variety, Charleston Gray, being most susceptible and Sugar Baby least.

MECHANIZATION (F.S. 9)

Use of mechanical equipment is an integral part of the objective of the project and experience gained to date is set out in some detail in the fact sheet. Highlighted are difficulties of obtaining and training personnel to use specialized equipment adapted to specific requirements of vegetable growing, with special reference to weeding, and the need and scope for improvisation and adaptation of existing equipment in several respects.

Attention has been paid to the testing of equipment which might be within the financial means of the smaller grower. Several types of hand operated equipment have been found to merit promotion among small farmers but so far no thoroughly satisfactory tractor of the walking type has been tested.

By means of mechanical equipment the direct seeding of most crops including onions, is now standard procedure. Planet Junior equipment has been found very satisfactory on both tractor drawn and hand operated equipment.

WEED CONTROL (F.S. 11)

Testing of many different types of herbicides in vegetables has been conducted from the beginning of the project. However, complete dependence on chemical methods of weed is not contemplated and chemical weed control will be used in co-ordination with other methods, including mechanical cultivation.

Satisfactory control of weeds has been achieved in sweet corn, tomatoes and carrots, although the cost of chemical control in carrots is high, and a problem of the residual effect of atrazine used in corn has been encountered.

The chemical control of weeds in onions has been actively investigated and experience has gradually been accumulated towards solving the many problems involved. Tillam, Randox and Daothal have been showing promising but not yet conclusive results. Less success in chemical weed control has been

achieved with cucurbits, pumpkins, melons and cucumbers which were very sensitive to the chemicals found harmless to other crop species at the concentrations applied.

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FOOD CROP RESEARCH IN PUERTO RICO

George Samuels

COFFEE

Varieties

Development of new coffee varieties by crosses or selection (H. 74)^{1/}
 Varietal collection of coffee (C. 252)
 Determination of coffee yields by varieties (H. 21)

Fertilizers

Time of fertilizer application for coffee (C. 249)

Management

Comparison of yields of coffee grown in shade or in full sun (H. 165)
 Studies on the vegetative propagation of coffee (H. 24)
 Methods of transplanting coffee (C. 250)
 Planting distances for coffee (C. 251)
 The economic possibilities of sun grown coffee production (C. 253)
 Development of a coffee harvester (H. 167)

Insects

Control of insects affecting coffee plantations (H. 72)

CITRUS

Varieties and Propagation

Development of new chironja selections (C. 317)
 Development of seedless oranges for eating and processing (C. 50)

^{1/}Research project number

Use of leaf anatomy to determine drought resistance in citrus (C. 383)

Fertilizers

Nutrition and liming for citrus (H. 148)

MANGOS

Selection of mangos for commercial value as fresh fruit and processing (C. 52)

AVOCADOS

Selection of avocados for local consumption and export (C. 53)

GUAVAS

Development and selection of new guavas varieties for fresh fruit and processing

PINEAPPLES

Development of new varieties
Agronomic aspects of pineapple cultivation

PROCESSING

Utilization of native fruits for processing (H. 29)
Dehydration of tropical fruit pulp and juices (H. 124)
Preparation of non-alcoholic tropical fruit beverages (H. 151)
Preparation of a coconut flavoring for processing and home use (H. 155)

MARKETING

Impact of changes in organization and marketing structure on fruit processing in Puerto Rico

VEGETABLES

Field trials to determine varietal adaptation (C. 229)
The biology and control of insects which attacks vegetables (C. 282)

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Development of new tomato varieties (H. 49)
Tomato marketing studies (H. 163)

GRAINS

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Rice production in the Lajas Valley (C. 318)

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Dehydration of root crops for production of flour (H. 125)

SWEET POTATOES

Breeding and selection of sweet potato varieties (C. 116)

BANANAS AND PLANTAINS

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NEW CROPS

Introduction and evaluation of new crops (H. 94)
Agronomy studies of growing cacao in the coffee region (C.346)

MARKETING

Potentials and perspectives of the marketing of agricultural products in Puerto Rico (H. 90)

INSECTICIDES

Determination of residuals of insecticides on coffee, pineapples, and tomatoes (H. 179)

NUTRITION AND HEALTH

Studies of the Puerto Rican diet (H. 41)
Vitamin B content of mavi (Colubrina Colubrina Jacq. Millsp.)

FOOD TECHNOLOGY AND PROCESSING

Preservation of tropical fruits by freezing (H. 109)
 Conservation of tropical fruits and vegetables by
 freeze drying (H. 149)
 Production of specialized foods using tropical fruits
 and vegetables as a base (H. 154)
 Preparation of tropical fruit syrups (H. 157)
 Canning of soups using local products (H. 134)
 New techniques in producing native cheese (H. 185)
 Papain production (C. 274)
 Processing native Puerto Rican dishes (C. 304)
 Microbiology of frozen products made in Puerto Rico
 (C. 376)

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 RESEARCH PROJECTS ON FOOD CROPS^{1/}
 SURINAM AGRICULTURAL EXPERIMENT STATION
1. Rice

1. fertilizer response, as related to local factors and methods of application;
2. water requirements in polders;
3. improvement of the physical environment of the rice plant through various tillage methods;
4. the adaptation of cultural methods to newly developed varieties of the japonica-type;
5. Surinam rice soils and the possibilities for crop rotation;
6. control of weeds
7. diseases and pests.

2. Sorghum

Growth, yield, resistance to diseases and pests of imported varieties

3. Corn

1. selection, for a more uniform product;

^{1/}Compiled from Exp. Sta. "Plan of Work" (1966-1970) by F. A. del Prado and J. A. Samson.

2. inbreeding program, crossing inbred lines to obtain a synthetic variety.

4. Vegetables

1. variety trials with tomato, stringbean, yard long bean, taro, cucumber and onion;
2. diseases and pests;
3. irish potatoes, preliminary tests.

5. Pulses

1. introducing new varieties of peanuts, mungbeans, black eye peas to the farmers;
2. diseases and pests.

6. Bananas

1. experiments on spacing, fertilizers, water requirements and width of beds;
2. comparison of spray oils against Cercospora;
3. epidemiological studies of Sigatoka;
4. control of nematodes:
 - a. treatment of suckers
 - b. use of nematocides
 - c. crop rotation
 - d. (flood) fallow

7. Citrus

1. virusfree budwood from Florida;
2. search for seedling trees with good properties;
3. rootstock experiments;
4. drainage experiments;
5. rustmite, fruit piercing moth, areolate leaf spot, greasy spot, scab and nematodes.

8. Fruit Trees

1. processing guava, West Indian cherry, papaya, passion-fruit, soursop, Pomme Malac (*Syzygium malaccense*) and Java Plum (*S. cumini*);
2. selection mother trees (avocado, guava, W. Ind. cherry);
3. vegetative propagation of fruit trees;
4. pests and diseases of fruit trees (esp. fruit fly of guava).

9. Oilpalm

1. selection of Dura mother trees;
2. crossing with Pisifera;
3. crossing Tenera with Tenera;
4. *Rhadinaphelenchus cocophilus* nematode (red ring) and little leaf complex.

10. Coconut

1. selection of highly productive dwarf coconut with high oil content;
2. diseases and pests;
3. coconut fibre for home industries (brushes).

11. Various

1. kitchen herbs)
 2. black pepper)
-) collections and cultural practices

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