FINAL REPORT
ADAPTIVE PRODUCTION ORIENTED RESEARCH PROGRAMME ON VEGETABLES - BRUMDEC
September 1981 - September 1982

IICA/Jamaica
Miscellaneous Publication #362
Series ISSN-0534-5391

FINAL REPORT

ADAPTIVE PRODUCTION ORIENTED RESEARCH PROGRAMME ON

VEGETABLES - BRUMDEC

SEPTEMBER 1981 - SEPTEMBER 1982

by

CHARLES PERCY KENNARD

VEGETABLE PRODUCTION SPECIALIST

IICA/JAMAICA

September, 1982

TABLE OF CONTENTS

INTRODUCTION

This report covers the period September 19th, 1981 to September 18, 1982 which was the period of assignment of the Consultant. The terms of reference for the Consultant during this assignment include:-

(i) Prepare for the advise of the client a programme of adaptive production oriented research (short term) aimed at solving the problems which obtain in vegetable production in the project area. Problems which were to be addressed include the appropriateness of vegetable crops and varieties within. The context of (a) Jamaican Consumer acceptance (b) Soil/water considerations (c) Seasonality of production (d) Culture and harvesting characteristics (e) Weed, pest and disease associations (f) Seed production (g) Fertilizer regime and (h) Crop density and yields

(ii) Initiate and implement a training programme for nation technicians consistent with the overall agronomy of vegetable production

(iii) Develop a technical package of practices for implementing on-farm vegetable cultivation under conditions which obtain in the project area

(iv) Determine these areas for future vegetable research

A period of one (1) year is generally considered to be too short a period for an applied research programme on crops. All that can be obtained during this short period of time is indications as to what is likely to happen. Research on a continuing basis must be done to up-date the available information. This is more than true in the case of the Applied Research Programme on Vegetables at BRUMDEC because of a number of additional constraints. Prior to the initiation of this programme very little work has been done on vegetables on the Peat in

Jamaica and none at all at BRUMDEC. As a consequence the Consultant had very little local information to guide him. Not even the sites for the field work were available and these could not be prepared until early January 1982, resulting in over 3 months delay. Delay were also experienced in procuring the inputs and having personnel assigned to the programme.

In spite of the constraints mentioned above, the work done over two seasons and has given very positive indications. that vegetable production can be done profitably within the project area. Commercial production of selected vegetables should now be attempted using the package of practices contained in the Third Quarterly Report and which also forms an attachment of this, the Final Report. In the meanwhile, further research along the lines suggested in the Third Quarterly Report(5) should be done to up-date and expand on the information available on vegetable production within the Project. The prospects for Vegetable Production at BRUMDEC holds out great possibility what needs to be done is to transform these possibilities into realities.

2. APPLIED RESEARCH PROGRAMME

First Season's Work (January - May 1982)

As previously mentioned the sowing of the crop for the first season was done much later than planned. This no doubt had some adverse effect on the yields of several of the crops which does best during the cooler months of the year e.g. Garlic, Cauliflower, Lettuce, Cabbage etc. On the other hand, it was much too late to sow the onion crop - a crop with great potential for production on the Peat. Nevertheless spectacular results in terms of yields were obtained with cabbage, tomatoes, lettuce, sweet peppers, egg plant, cucumbers and string beans on the Peat. Encouraging results were also obtained on the Four Paths Clay Loam with tomatoes, sweet peppers, egg plant, carrots and cabbage. The indications are that high yields can also be obtained with water-melons on the Morass Peat Soil and Four Paths Clay Loam. However, the quality aspect of the fruits on the Peat would need further investigation and the overall problem of praedial larceny would have to be tackled. The results and methodology of the first season's work are detailed in the Third and Second Quarterly Report respectively (4,5).

2.2. Second Season's Work

Sowing of the crop during the seasonseason was done as scheduled. The intentions being that the sowing should be completed by the end of April and before the advent of the very heavy rains in May. Unfortunately, a number of circumstances contributed to the entire experimental site being flooded out and all of the experiments and semi-commercial trials being destroyed. The rainfall during May was some 22.07 inches (560mm) which was nearly twice the average monthly precipitation of the Santa Cruz area (11.1 inches) for the years 1931-1960. This together with the fact that the area allocated to the trials were located on the lower part of the peat were the main contributary causes. The end result of the flooding of the plots and the destruction of the experiments have left several gaps in the programme.

(i) Work on several of the crops could only be done during one season (January - April)

(ii) No results could be obtained with onions - a crop which appears to have great potential for cultivation on the Peat. A few of the plants which survived the flood produced reasonably sized bulbs.

(iii) Only one fertilizer study on the Peat could have been completed. Accurate information is therefore not available and over the different seasons. Recommendations on fertilizer treatments incorporated in the package of practices are based mainly on work done elsewhere and may not be the best treatments for vegetables grown within the project.

(v) No information could be obtained on the effects of the micro-nutrients (Ca, Zn, B, Mn) on yields, quality etc.

Although it was not possible to resow the field experiments and in spite of the lateness of the season, the following semi-commercial trials were re-sown:

(i) Cabbage Variety K.K. Cross
(ii) Tomatoes Variety Floradale, Manapal and Malalucie
(iii) Ochro Variety Emerald
(iv) Cucumber Variety Ashley and Cheroke
(v) Watermelon Variety Sugar Baby, Charleston Gray and Jubilee
(vi) Sweet Corn Variety Florida Staysweet

Details of the cultural practices, fertilizer treatments etc. for the above are presented in the Third Quarterly Report.

In addition the following were also sown:

(vii) Egg Plant - Semi-Commercial Trial
(viii) Sweet Pepper - Observational Trial
(ix) Squash - Observational Trial
(x) Cantaloupe - Observational Trial
(xi) Dasheen - Observational Trial
(xii) String Bean

The details concerning these are presented below:

2.2.1. Egg Plant Semi-Commercial Trial

2.2.1.1. Layout

Sown on five (5) flat beds each measuring 1.8 x 32.4m with drain 45cm between each bed.

2.2.1.2. Variety

Black Beauty

2.2.1.3. Seeding/Spacing

Direct seeding on the 16th June with spacing between rows and plants in the rows being 90cm and 75cm respectively. Thinned on the 15th July (30 days after seeding) to one plant per hole.

2.2.1.4. Fertilizer Treatment

P_2O_5 - 180 kg/ha
K_2O - 269 kg/ha
Cu - 8 kg/ha

Applied prior to seeding on the surface of the soil

2.2.2. Sweet Peppers - Observational Trial

2.2.2.1. Layout

2.2.2.2. Variety

California Wonder
Resistant Giant
Yole Wonder

2.2.2.3. Seeding/Spacing

Direct seeded on the 16th June with spacing between rows being 60cm and between plants in the row 45cm.

2.2.2.4. Fertilizer Treatment

P_2O_5 - 135 kg/ha
K_2O - 180 kg/ha
Cu - 8 kg/ha

Applied to the surface of the soil prior to seeding

2.2.3. Squash - Observational Trial

2.2.3.1. Layout

Sown on three (3) flat beds each measuring 1.8 x 21.4m

2.2.3.2. Variety

Crookneck Early Summer Yellow

2.2.3.3. Seeding/Spacing

Direct seeding with one row planted in the centre of each bed with spacing between plants being 1.8m. Because of the dwarfness of the variety a closed spacing could have been used - two rows being placed in each bed with spacing between rows and plants in rows - 0.9m. Sowing done on the 7th July and thinning done on the 19th July with two (2) plants left on each mound.

2.2.3.4. Fertilizer Treatment

P_2O_5 - 50 kg/ha
K_2O - 100 kg/ha

The fertilizers applied much later than planned - some twenty seven (27) days after seeding and at the time of fruiting.

2.2.4. Cantaloupe - Observational Trial

2.2.4.1. Layout

Sown on flat bed approximately 400 sq. metres

2.2.4.2. Variety

Edisto

2.2.4.3. Seeding/Spacing

Direct seeding on the 17th June with spacing being 1.8 x 1.8m.

2.2.4.4. Fertilizer Treatment

P_2O_5 - 80 kg/ha
K_2O - 160 kg/ha

Application of fertilizer made by broadcasting to the surface of the soil on the 3rd August (48 days after sowing). The fertilizer should normally have been applied just prior to seeding.

2.2.5. Dasheen - Observational Trial

2.2.5.1. Layout

Sown on a flat bed approximately 832 sq. metres

2.2.5.2. Variety

Unknown - Planting material obtained from St. Elizabeth.

2.2.5.3. Spacing

Tubers planted on the 28th June to a spacing of 0.9x 0.9m.

2.2.5.4. Fertilizer

None Applied

2.6.1. String Beans - Observational Trial

2.2.6.1. Layout

Each variety sown on a flat bed 1.8m x 10.2 (18.4 sq. metres) with drain 30cm deep between beds.

2.2.6.2. Variety

Tender Best
Top Crop
Contender

2.2.6.3. Seeding/Spacing

Direct seeding on the 15th June and thinned on the 10th June (15 days after sowing) with spacing between rows being 30cm and between plants - 15cm.

2.2.6.4. Fertilizer Treatment

P_2O_5 - 67 kg/ha
K_2O - 135 kg/ha
Cu - 8 kg/ha

Application was made by broadcasting to the surface of the soil on the 5th May prior to the flooding of the plots

2.2.7. General Progress of Crop during the Second Season

Whilst the growth of the crops seems to be reasonably satisfactory most of the crops do not appear to be performing as well as they did during the first season. This is probably as a result of the rather dry, hot and humid conditions which prevailed through mid-June to end of August. These conditions are likely also to have adverse effects on fruit set and consequently on yields. The crops which do appear to be least affected by the prevailing conditions are Ochroes, Egg Plant, Sweet Corn, Squash, Cucumbers, Watermelons and Cantaloupe. The progress of the individual trial are present below. Unfortunately the harvesting would not be completed for the final results to be included in the report. Yields of some of the vegetables are presented in Appendix II.

2.2.7.1. Tomatoes - Semi-commercial trial

The major problems encountered in the growing of the crop so far has been due to collar and root rot which has resulted in the death of quite a number of plants. The variety Manapal is more seriously affected than Manalucie or Floradade. Fruiting occurred in lower than the previous season.

2.2.72. Cabbage - Semi-commercial trial

The main problem encountered in the growth of the crop up to this stage is the damage done to the seedlings by cutworms and crickets. "Head" formation commenced some fifty-eight days after sowing.

2.2.7.3. Ochro - Semi-commercial Trial

Of all the crops being evaluated during the present, the ochro seems to be performing the best. The growth is extremely vigorous and there has been few problems with pests and diseases. The leaf eating chrysomelid beetles have been the only pests of any consequence.

Harvesting of the fruits commenced on the 10th of August fifty-six (56) days after sowing.

2.2.7.4. Cucumbers - Semi-commercial Trial

Harvesting of fruits commenced on the 5th August, fifty-two (52) days after sowing. The average size of fruits was 313 and 292 gm for Cherole and Ashley respectively. At the end of the harvest 18,700 kg and 14,200 kg/ha of marketable fruits were harvested from Cherokee and Ashley respectively. The leaf eating chrysomelid beetles were the main pests. Downy mildew was the only disease observed and the incidence was very light.

2.2.7.5. Watermelon - Semi-commercial Trial

All three varieties were affected by Anthracnose disease but the incidence was much more severe on the variety Sugar Baby. This variety appears to be an early and prolific producer. The fruit of this variety is rounded and dark green in coloration. It is smaller in size (av. weight - 35 kg) when Charleston Gray (6-8 kg) and Jubilee (6-8 kg). Praedial larcency and the quality of the fruits continues to be the main problem in growing watermelons.

2.2.7.6 Sweet Corn - Semi-commercial Trial

This crop has been subjected to attack by insects from the time it was sown until it was harvested. This required the application of insecticides on a twice weekly basis. The high case of insect control would make it almost uneconomical to grow the crop.

The high incidence of pests is due in a large part to the fact that the area on which the sweet

corn was grown is surrounded by thousand of acres infected with grass weeds. The end result of this is that there is a constant migration of the pests from the grass weeds to the more tender and attractive sweet corn. The two main pests encountered were cutworms and armyworms. As the surrounding area is cropped and a large area is put under sweet-corn, the pest problem is likely to become less acute. The eating qualities of the grains were very good and the yields of 3,712 kg/ha of cobs was within acceptable limits.

2.2.7.7. Egg Plant - Semi-commercial Trial

No serious problem has been encountered in the growing of the crop. The leaf eating chrysomelid beetles were the only pests of significance. This crop seems to be well adopted for growing during the present hot, dry season.

2.2.7.8. Sweet Pepper - Observational Trial

All three varieties have shown satisfactory growth so far with pests and disease problems being almost non-existant. Harvesting of the peppers in all three (3) varieties commenced some seventy-nine (79) days after sowing.

2.2.7.9. Squash - Observation Trial

The growth of the variety has been quite remarkable. It is extremely vigorous and has been free from pests and diseases. It started to produce fruits - only twenty-seven (27) days after sowing. It has been indicated that for the American market, the Swuash should be about 6 - 8" (15-20 cm). This means that for this market, harvesting can commence about five (5) weeks after sowing and would have

to be done every 2 to 3 days. With the Advent of the rains towards the end of August early September there has been some rot of the fruits. This indicates that for the best results sowing must be done so that harvesting is done in the dry.

2.2.7.10. Cantaloupe - Observational Trial

The growth of the crop has been quite satisfactory. The leaf eating chrysomelid beetles has been the main pests. A slight attack of the disease - Downy mildew also occurred. Fruiting commenced some fifty-three (53) days after sowing. Praedial larcency is likely to be one of the main constraints in growing this crop. The average size of fruits is between 2 - 3 kg.

2.2.7.11. Dasheen - Observation Trial

This crop is a natural for the pest soil if market can be found for the tubers. Without the application of fertilizers, the growth of the crop has been most satisfactory and there has been no pest and disease problems.

2.2.7.12. String Beans - Varietal Observation Trial

This crop or at least the varieties seem less adopted to the prevailing conditions. The growth of the varieties - Tender Beet and Top Crop was very poor, and failed to produce any yields. The growth of the variety contender was also disappointing.
Harvesting of the beans from this variety commenced some 56 days after sowing and only lasted for eight (8) days. The yield was very low equivalent to 1,056 kg/ha. The yields from the variety harvester on the Peat during the

previous season when conditions were more favourable for the crop was 8,111 kg/ha.

3. TRAINING OF NATIONAL TECHNICIANS

This aspect of the programme has suffered because no counterpart at the graduate level was appointed full time to the programme. For several months and at the inception, no counterpart was assigned to work along with the Consultant. Subsequently one was assigned on a part-time basis but he left before the second season work started.

Mr. Noel Austin, the Research Assistant who was assigned to the Vegetable Programme from the 1st January 1982, has done a commendable job. The on the job training and experience gained during the past nine (9) months would have served him in good stead if and when BRUMDEC decides to go into large scale proudction of vegetables. Unfortunately, he has left to further his studies. A number of the workers who were involved in the field operations on a regular basis has developed certain skills which can be utilized in the vegetable programme. The Applied Research Aspect would need some one at the graduate level to continue the research work and to oversee the commercial production.

The Consultant participated in one training session for the Supervisory staff at which certain aspect of vegetable production was dealth with.

4. POTENTIAL MARKETS FOR VEGETABLES

The first step in any production process must of necessity, be to locate the markets for disposal of the product or produce and at the sametime looking at the market requirements in terms of volume, quality, packing, period of supply etc. At this point in time, there seems to be several potential markets for vegetables produced in Jamaica and the Black River Upper Morass Development Project - (BRUMDEC) can play a significant role in supply these markets. These potential markets are discussed.

4.1. WINTER MARKETS IN U.S.A. AND CANADA

A study carried out by Luis Berger Int. (6) indicates that there is a potential market in the U.S.A. and Canada for a number of vegetables between January - June. These vegetables include carrots, cucumbers, egg plant, okra, pepper (sweet) and tomatoes. Further details are given in Appendix V which has been extracted from Luis Berger Report.

The Arthur Young Study (7) done on behalf of the J.N.E.C. also emphasised the potential of this market in the U.S.A. The report pointed out that this market has expanded and the volume imported has risen considerably in the past decade but inspite of the increased imports, "gaps" in the supply still exist and which are reflected in high prices, unavailability of supplies, poor quality etc. at certain periods. The main suppliers of this market in the North Eastern U.S.A. include Mexico, Chile and Haiti. Little if any Jamaican produce is imported to the U.S. markets at the present time and as yet there is little or no commercial production being geared to meet this market. The Arthur Young Study indicates that under the existing conditions for production in Jamaica, those most likely to be successfully grown include peppers (green), egg plant, acorn squash, cantaloupe, honey, melons.

4.2. ETHNIC MARKETS

The Arthur Young Study (7) indicates that because of the large Latin American and West Indian population in the U.S., there is a sizeable market for fresh produce from the Caribbean and South America. As for as the Caribbean is concerned, this would also be true for Canada and the U.K. Among the agricultural produce which can be exported to this market which is available all year round are Dasheen, Cho-cho, Pumpkin. The indications are that there could be immediate increases in the sale to these markets if there were greater regularity in shipments and some attention was paid to quality.

4.3. CARICOM AND OTHER CARIBBEAN MARKETS

As shown in Appendix VI which is an extract from the Luis Berger Study (6), there is a substantial market in the CARICOM and other Caribbean countries. Vegetables imported into the region include onions, garlic, carrots, tomatoes, cabbage etc. Most of these if not all can be produced within the region and BRUMDEC can cash in on this particularly during the off season.

4.4. MARKETS WITHIN FOOD PROCESSING INDUSTRIES

The Arthur Young Study (7) mentioned the fact that Jamaican Food Processors have been quite successful in developing exports markets for their products in the Caribbean, Canada and U.K. Less success was achieved in the U.S.A., but it was felt that this market could be expanded with adequate planning and marketing. Among the products processed for exports are Pepper Sauces and Pickled Pepper. Any expansion of the Food Processing Industries whether the processed items are for local consumption or for export would require increased production of the basic material and on a regular basis.

4.5. LOCAL MARKETS FOR FRESH VEGETABLES

Jamaica imports substantial quantities of certain vegetables eg. garlic, onions etc. markets for which are also available in other countries. It would also appear that during the Tourist Season (Winter Season) there is a shortage of certain selected vegetables e.g. lettuce, radish, beets etc. all of which can be produced locally and even at BRUMDEC. As the Tourist Trade further expands, shortages of these vegetables are likely to become acute if production for this market is not undertaken.

4.6. PLANNING FOR PRODUCTION

At this point in time there seems to be some reservation as to whether BRUMDEC should be involved in vegetables production at all. Given the potential markets for vegetables, the spectacular results obtained during the past year, the profitability of vegetable production and the large tract of unutilised lands which are more suitable

for vegetables than any other known crops, such reservation cannot be fully justified.

Planning for production needs to be done almost immediately so that commercial production on a phased basis can commence as soon as possible. In planning for production, attention must be given to:

(i) selection of the most suitable sites and reproducing them with the additional infra-structural works,

(ii) procuring the equipment for land preparation, plant protection, harvesting, storage, pack etc.,

(iii) recruiting and training the personnel who would be responsible for the commercial production. A probably phasing of the actual production could be as shown in Appendix I. The acreages and crops can be adjusted as the market dictates.

5. SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

(i) Work during the first season (January to May) and more recently during May to September has clearly indicated that there is great potential for vegetable production within BRUMDEC and particularly on the Peat.

(ii) The best season for production appears to be the period November to March when conditions are most favourable for growth and harvesting of the vegetables. Production during this period could be geared to meet the winter markets in the U.S.A. and Canada, the demands of the local tourist trade and the Processing Industries. The vegetables which can be produced on the Peat during this season include tomatoes, sweet and hot peppers, cabbage, lettuce, string-beans, egg plant, cucumbers, squash and okra. Subsequent work may also

prove that onions, carrot and even garlic can be grown. Good yields can also be obtained by growing certain vegetables eg. tomatoes, cucumbers, carrots, watermelons, sweet and hot peppers on the Four Paths Clay Loam - 204 during this season.

(iii) High yields and economic returns can also be obtained by growing selected vegetables on the Peat during the period - April to September. The vegetables most likely to produce the best results include eggplant, squash, cucumbers, okra, sweet and hot peppers, onions and carrots. Production during this period can be utilized to supply the Processing Industries, Ethnic Markets, CARICOM and Local Markets.

(iv) Fertilizer studies on the Four Paths Clay Loam - 204 have indicated that the best result can be obtained on tomatoes through the application of 60N-90P - 135K or 45N - 135P - 90K and for carrots - 60N - 90P - 120K. These fertilizer treatments are being recommended for use on these vegetables until further results are obtained through experimentation.

(v) Only one fertilizer study could have been completed on the Morass Peat Soil - 152 that on cabbage done during January - April. The best results in terms of profitability and quality of produce were obtained with the application of 200P and 250K. Further studies need to be done with the different vegetables over several season to obtain additional information on the fertiliser requirements for the different crops. The fertiliser recommendations included in the package of practices now being advocated are based on work done elsewhere and from field observations.

(vi) The soil analyses of the Peat has shown Copper to be the only micro-nutrient which is dificient in the soil and it was the only one applied. Work which was initiated to determine whether any benefits could be derived from the application of the other micro-nutrients eg. Boron, Manganese, Zinc etc. were not completed because of the flooding of the plots. This work should be done sometime in the near future.

(vii) The Applied Research Work done during the year can only serve to provide indications as what is likely to happen. Research on a continuous basis must be done to:

(a) up-date the available information,
(b) obtain additional information on new crops and varieties;
(c) determine the N.P.K. and micro-nutrient requirements for the different vegetables;
(d) investigate the incidence of pests, diseases, weeds and their control etc.

6. ACKNOWLEDGEMENTS

The Consultant wishes to acknowledge with sincere thanks the help and assistance give to him by the staff of IICA, BRUMDEC, Ministry of Agriculture and other agencies in his assignment and in making his stay in Jamaica a pleasant and memorable one. Particular mention need to be made of the following:-

- Dr. Percy Aitken-Soux - Director IICA/Jamaica
- Mr. Lloyd Logan - Managing Director/BRUMDEC
- Mr. Vivian Chin - Consultant/IICA
- Dr. Irving Johnson - Agricultural Economist/IICA
- Mrs. Lindsey Miller - Administrative Assistant/IICA
- Mrs. Judith Wedderburn - Administrative Assistant/IICA

- Mr. S. Ghaznavi	- Agricultural Manager/BRUMDEC
- Mr. Bobby Stephens	- BRUMDEC/JNIC
- Mr. Derrick Smith	- BRUMDEC
- Mr. Nigel Austin	- BRUMDEC
- Mr. Donald Malcolm	- BRUMDEC
- Mrs. Rose Evans	- BRUMDEC
- Miss Margaret Wright	- BRUMDEC
- Miss Beverly Tennents	- BRUMDEC
- Mr. Malcolm E. Easy	- Formerly of BRUMDEC
- Mr. Basil Williams	- BRUMDEC
- Miss Karen Riley	- IICA
- Miss Maxine Brown	- IICA
- Miss Latita Williams	- IICA

7 7. REFERENCES

1. KENNARD, Charles - Summary of the Proposed Programme of Work for Adaptive Production - Oriented Research (short-term) in Vegetable Production in the BRUMDEC Project. Misc. Publication 319, IICA/Jamaica, January 1982.

2. KENNARD, Charles, - Vegetable Production (BRUMDEC) Review and Proposed Short-Term Adaptive Production Oriented Research Programme. Misc. Publication No. 320, IICA/Jamaica, January 1982.

3. KENNARD, Charles - Vegetable Production Programme (BRUMDEC) First Quarterly Report. IICA/Jamaica, December 91981.

4. KENNARD, Charles - Vegetable Production Programme - BRUMDEC Second Quarterly Report. Misc. Publication No. 353. IICA/Jamaica, April 1982.

5. KENNARD, Charles - Vegetable Production - BRUMDEC. Third Quarterly Report. Misc. Publication No. 322. IICA/Jamaica, July 1982.

6. BERGER, Louis - Int. Inc. and Systems. Small Farmers Production and Marketing System Study,

7. YOUNG, Arthur - The Export Market in the United States for Jamaican Agricultural and Horticultural. Products Prepared for Jamaica National Export Corporation, JULY 15, 1981

APPENDIX I

PROBABLE PHASING OF PRODUCTION

Year	Growing Season	Crops	Acreage	Growing Season	Crops	Acreage
I	September - March	Cucumber, Okra, Egg Plant, Tomatoes, Squash, Sweet Peppers, Cantaloupe	50	April - September	Okra, Egg Plant Squash, hot peppers	50
II	September - March	Cucumbers, Okra, Egg Plant, Tomatoes, Squash, Sweet Peppers, Cantaloupe, Onions	150	April - September	Okra, Egg Plant, Squash, Peppers, Onions, Carrots	50
III	September - March	Cucumbers, Okra, Egg Plants, Tomatoes, Squash, Sweet Peppers, Cantaloupe, Onions etc.	300	April - September	Okra, Egg Plant, Squash, Peppers, Onions, Carrots Sweet Corn	150
IV	September - March	Cucumbers, Okra, Egg Plant, Tomatoes, Squash, Sweet Peppers, Cantaloupe, Onions, Sweet corn, Lettuce etc.	500	April - September	Okra, Egg Plant, Squash, Peppers, Onions, Carrots Sweet corn	250

APPENDIX II

YIELDS OF VEGETABLES GROWN DURING THE PERIOD JUNE TO SEPTEMBER, 1982 ON MORASS PEAT SOIL

Crop	Variety	Duration of harvesting-Days after sowing		Yields (kg/ha)		Remarks
		First Harvesting	Less Harvesting	Total	Marketable	
Cucumber	Ashley	52	80	18,250	14,200	Period of harvesting on peat relatively short.
	Cherokee	52	80	22,500	18,700	
Sweet Corn	Florida Staysweet 5204	68	76	5,276	3,712	Heavy infestation of army worm and earworm affected marketable yields
Okra	Emerald	56	N.A.	4,500	4,500	Harvesting still in progress
Squash	Crookneck Early Summer Yellow	42	N.A.	8,069	6,960	Harvesting still in progress
String Beans	Contender	56	64	1,056	1,056	Yields very low. Crop not adopted to hot, dry conditions
Watermelons	Sugar Baby	66	90	28,362*	28,362*	Yields of watermelons had to be estimated because of praedial larceny
	Jubilee	76	110	45,000*	45,000*	
	Charleston Gray	80	110	31,379*	31,379*	
Sweet Pepper	Californa Wonder	79	N.A.	N.A.	N.A.	Harvesting just commenced
	Resistant Giant	79	N.A.	N.A.	N.A.	
	Yole Wonder	78	N.A.	N.A.	N.A.	
Cabbage	K.K. Cross	N.A.	N.A.	N.A.	N.A.	Harvesting not yet started
Tomatoes	Floradade	N.A.	N.A.	N.A.	N.A.	Harvesting not yet started
	Manalucie	N.A.	N.A.	N.A.	N.A.	
	Manapal	N.A.	N.A.	N.A.	N.A.	
Cantaloupe	Edisto	84	N.A.	10,200*	10,200*	Harvesting just commenced
Egg Plant	Black Beauty	85	N.A.	N.A.	N.A.	Harvesting just commenced

* Estimated yields, N.A. Not available

APPENDIX III

TIME OF SOWING, SPACING, SEEDRATE AND PERIOD OF MATURITY OF SELECTED VEGETABLES

Crop	Varieties	Time of Sowing	Spacing	Seed Rate (kg/ha) Direct Seeding	Transplanting	Period of Harvesting Days after sowing
Cabbage	K.K. Cross	September - end December	Between rows -60 to 75cm	1.12-1.40	0.28-0.40	85-120
	Y.R. Summer Roundup	Mid March - Mid April	Between plants -45cm			
Lettuce	Great Lakes	November - Mid December	Between rows - 60cm	1.68-2.25	0.28-0.40	50-80
	Minetto	November - December	Between plants-30cm			
	Mignonette	Mid March Mid April	Between rows -45cm, 20 cm between plants			
Tomatoes	Floradade, Tropic Manapal, Roma VF	September end December Mid March-Mid April	Between rows 75cm Between plants - 60 to 75cm	0.84-1.12	0.28-0.56	85-120
Egg Plant	Black Beauty Long Purple	September - Mid January Mid March -Mid June	Between rows 75-90cm Between plants - 60-75cm	1.12-1.40	0.28-0.40	90-140
Sweet Pepper	Resistant Giant California Wonder	September end December Mid March - Mid April	Between rows 60-75cm Between plants 45-60 cm	1.12-2.0	0.28-0.40	80-130
	Yole Wonder	Mid March-Mid April	Between plants 45-60cm			
Hot Pepper	Scotch Bonnet	September end December Mid March - Mid April	Between rows 75-90cm Between plants 75cm	1.12-2.0	0.28-0.40	130-180
String Beans	Harvester	Mid November - Mid January	Between rows 30-40cm Between plants 10-15cm	70-80		45-90
Watermelons	Charleston Gray	Mid November - Mid December Mid March - Mid May	Plant single row in beds 1.5-1.6m wide spacing between plants in bed-1.8m	1.4-2.0		70-110

APPENDIX III (CONT'D)

Crop	Variety	Time of Sowing	Spacing	Seed Rate (kg/ha) Direct Seeding	Transplanting	Period of Harvesting Days after sowing
Cucumbers	Ashley Poinsett, Cheroke	Mid November - Mid January Mid May - Mid June	Plant single row of plants in beds 1.5 - 1.6m wide spacing between plants in bed 1.2m	2.25-3.0	-	45-9-
Carrots	Danvers 126 Danvers Half Long	September end December Mid March - Mid April	Between rows 30cm and thin to spacing of 10cm between plants at 4-6 weeks	2.25-4.5	-	110-130
Okra	Emerald	September - Mid January Mid April - Mid June	Between rows - 75cm Between plants - 60cm	0.84-1.0	-	56-120
Squash	Crookneck Early Summer Yellow	Mid November - Mid January Mid May - Mid June	Plant single row in centre of each bed with spacing between plants - 1.2m	1.4-2.0	-	42-90

APPENDIX IV

SUMMARY OF FERTILIZER RECOMMENDATIONS FOR SELECTED VEGETABLES

Crop	Morass Peat Soil Rate of Application (kg/ha)	Four Paths Clay Loam Rate of Application (kg/ha)	Remarks
Tomatoes, Egg Plants Sweet Peppers, Hot Peppers	P_2O_5 - 180 K_2O - 260	500 kg of 6:18:27 fertilizer Mixture containing 60N-90P-135K	(i) On Morass Peat application of fertilizer to be made to surface of soil one (1) week prior to seeding. (ii) On Four Paths Soil - Fertilizer must be encooperated with the soil one (1) week before sowing or transplanting (iii) Application of 8 kg/ha of Ca should be made to peat soil being cropped for the first time.
Cabbage	P_2O_5 - 200 K_2O - 250	-	
Lettuce	N - 20 P_2O_5 - 200 K_2O - 250	-	
String Beans	P_2O_5 - 67 K_2O - 120	-	
Cucumbers Watermelons Cantaloupe	P_2O_5 - 50 K_2O - 150	628 kg of 7:14:14 or 377 kg of 12:24:12	
Okra	P_2O_5 - 90 K_2O - 150	-	
Sweet Corn	P_2O_5 - 180 K_2O - 260	-	
Squash	P_2O_5 - 90 K_2O - 150	-	
Carrots	P_2O_5 - 225 K_2O - 270	N - 60 P_2O - 90 K_2O -120	
Onions	P_2O_5 - 150 K_2O - 200	-	

APPENDIX V

SUMMARY OF ESTIMATED COST OF PRODUCTION AND RETURNS FOR SELECTED VEGETABLES PLANTED ON THE MORASS PEAT SOIL

Crop	Anticipated Productions (lbs/acre)	Unit Price (cts/lb)	Estimated cost of Production J$ per acre	Gross Revenue J$ per acre	Net Return J$ per acre
Sweet Peppers	10,000	40	2,981	4,000	1,019
Tomatoes	16,000	30	3,837	4,800	963
Egg Plant	10,000	40	2,540	4,00	1,460
Cabbage	15,000	30	2,606	3,600	994
Cucumbers	15,000	25	2,244	3,750	1,506
Watermelons	20,000	30	2,800	6,000	3,200
Okra	8,000	40	1,800	3,200	1,400

APPENDIX VI

POTENTIAL CANADIAN AND U.S.A. MARKETS FOR VEGETABLES

Product	Canadian Market		U.S.A. Market	
	Estimated Open Market (Metric tons)	Open Seasons	Estimated Open Market (Metric tons)	Open Seasons
Green Beans	200	February - May	1,600	March - April
Carrots	600	January - February	6,600	January - February
Cucumbers	1,300	February - April	14,000	March-mid April
Egg Plant	900	January - June	10,000	February - June
Onions (fresh)	300	January - March	3,000	January - February
Onions (dry)	1,000	February - May	10,000	March - April
Okra	300	February - June	3,000	March - May
Peppers	1,400	February - June	15,000	Mid March May
Tomatoes	6,000	February - May	90,000	March - April

Source: Small Farmers Production and Marketing Systems Study: Louis Berger Int. Inc. and Systems

APPENDIX VII

IMPORTATION OF VEGETABLES - CARICOM AND OTHER CARIBBEAN COUNTRIES

Country	Estimated Quantities of current Demand Supplied by Imports (Per Cent)
CARICOM	
Antigua	54
Barbados	45
Belize	34
Dominica	15
Grenada	8
Guyana	34
Jamaica	12
Montserrat	20
St. Kitts/Navis	54
St. Lucia	50
St. Vincent	38
Trinidad & Tobago	25
OTHER CARIBBEAN COUNTRIES	
Guadelope	15
Martinique	16
Netherlands Antilles	100
Puerto Rico	89
Surinam	48
Venezeula	5
Virgin Islands (U.S.)	96
Virgin Islands (U.K.)	

Source: Small Farmer Production and Marketing System Study. Louis Berger Int. Inc. and Systems

APPENDIX VIII

RAINFALL DATA - JUNE TO AUGUST 1982

	JUNE	JULY	AUGUST
1	0.0	0.0	0.0
2	0.0	0.0	0.5
3	0.0	0.0	0.0
4	0.0	5.5	0.0
5	0.0	6.0	15.0
6	0.0	0.0	0.0
7	27.0	0.0	5.0
8	0.0	20.5	0.0
9	22.5	5.5	0.0
10	0.0	9.0	0.0
11	0.5	0.0	0.0
12	0.0	0.0	15.5
13	0.0	2.5	7.0
14	0.0	0.0	0.0
15	0.0	0.0	0.0
16	0.0	0.0	0.0
17	0.0	0.0	0.0
18	0.0	15.0	0.0
19	0.0	0.5	0.0
20	0.0	0.0	1.0
21	16.0	13.5	1.5
22	3.5	0.0	0.0
23	0.0	0.0	0.0
24	0.0	0.0	7.7
25	0.0	3.5	0.5
26	0.0	1.0	15.0
27	0.0	0.0	0.5
28	0.0	0.0	2.5
29	4.5	19.0	2.0
30	0.0	0.0	63.0
31	-	0.0	10.5
Total (mm)	74.0	101.5	143.0
1" (inches)	2.91	4.0	5.63

Source: Rice Station, Elim, St. Elizabeth

FIGURES

Fig. I - Carrots sown on ridges on Four Paths Clay Loam

Fig. II - String beans growing on ridges on Four Paths Clay Loam

FIGURES

Fig. III - Flat beds with drains between used for planting vegetables on Peat

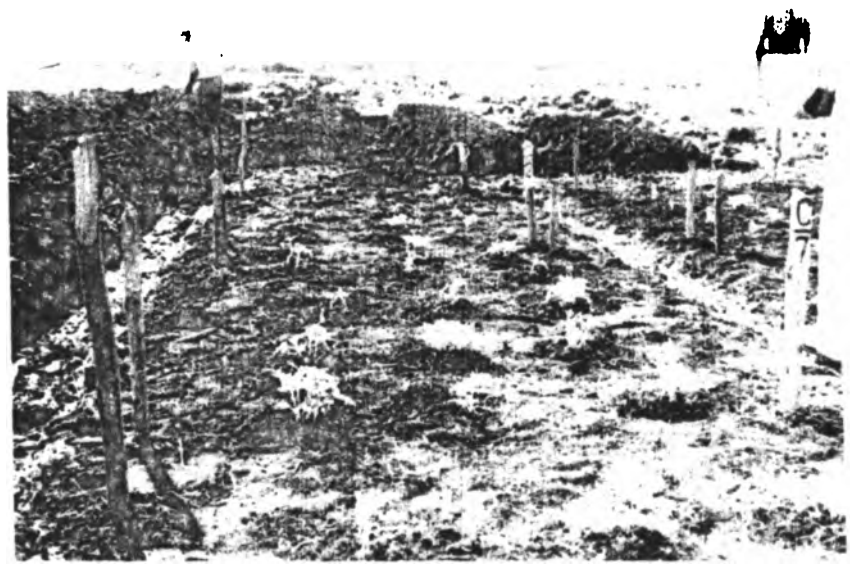


Fig. IV - Shows excellent germination of tomatoes direct seeded on flat-beds on Peat

AGRICULTURE IN JAMAICA

Collection of papers of the Office of IICA in Jamaica

1977 - 1978

No. I - 1 Fritz Andrew Sibbles, "Basic Agricultural Information on Jamaica Internal Document of Work", January 1977

No. I - 2 Yvonne Lake, "Agricultural Planning in Jamaica", June 1977

No. I - 3 Aston S. Wood, Ph. D., "Agricultural Education in Jamaica", September - October 1977

No. I - 4 Uli Locher, "The Marketing of Agricultural Produce in Jamaica", November 1977

No. I - 5 G. Barker, A. Wahab, L. A. Bell, "Agricultural Research in Jamaica", November 1977

No. I - 6 Irving Johnson, Marie Strachan, Joseph Johnson, "Land Settlement in Jamaica", December 1977

No. I - 7 Government of Jamaica, "Agricultural Government Policy Papers", February 1978

No. I - 8 Jose Emilio Araujo, "The Communal Enterprise", February 1980

No. I - 9 IICA and MOAJ, "Hillside Farming Technology - Intensive Short Course", Vols, I and II, March 1978

No. I - 10 Jose Emilio Araujo, "The Theory Behind the Community Enterprise - Seminar in Jamaica", March 1978

No. I - 11 Marie Strachan, "A National Programme for the Development of Hillside Farming in Jamaica", April 1978

No. I - 12 D. D. Henry, "Brief Overall Diagnosis of Hillside Farming in Jamaica", April 1978

No. I - 13 Neville Farquharson, "Production and Marketing of Yams in Allsides and Christiana", May 1978

No. I - 14 R. C. E. McDonald, A. H. Wahab, "Fertility Assessment of Newly Terraced Hillside Soils Using the Microplot Technique - the Allsides Case Study", 1978

No. I - 15 IICA - IDB, "Course in Preparation and Evaluation of Agricultural Projects", Vols. I and II, November 1977

No. I - 16 Neville Farquaharson, "Production and Marketing of Dasheen in Allsides and Christiana", June 1978

1978 - 1979

No. II - 1 O. Arboleda-Sepulveda (IICA-CIDIA), "Agricultural Documentation and Information Network in Jamaica", September 1978

No. II - 2 Victor Quiroga, "National Agricultural Information System", (NAIS-Jamaica) Project Profile, September 1978

No. II - 3 Joseph Johnson, "A Review on Land Reform in Jamaica for the Period 1972 - 1978", September 1978

No. II - 4 Neville Farquharson, "ABC of Vegetable Farming", A Draft High School Textbook, Vols. I, II, III and IV, February 1979

No. II - 5 Jerry La Gra, "Elements of an Agricultural Marketing Strategy for Jamaica", March 1979

No. II - 6 D. D. Henry, I. E. Johnson, "Agricultural Extension Service in Jamaica", March 1979

1979 - 1980

No. III - 1 H. R. Stennett, "Watersheds of Jamaica and Considerations for an Ordinal Scale of Their Development", July 1979

No. III - 2 IICA-MAJ, "Hillside Farming in Jamaica", A Training Seminar, December 1978

No. III - 3 A. L. Wright, A. H. Wahab, H. Murray, "Performance of Six Varieties of Red Peas (Phaseolus vulgaris L.) on a Newly Terraced Ultisol in Jamaica", September 1979

No. III - 4 IICA Jamaica Staff, "Agro-Socio-Economic Sample Survey of Allsides - Trelawny, Jamaica", September 1979

No. III - 5 IICA-MOAJ, "An Approach to Agricultural Settlement of Hilly Lands", October 1979

No. III - 6 IICA-MOAJ, "Tree Crops of Economic Importance to Hillside Farms in Jamaica", October 1979

No. III - 7 Canute McLean, "Production and Marketing of Peanuts", November 1979

1980

No. IV - 1 Joseph Johnson, "Production and Marketing of Red Peas in the Hilly Areas of Jamaica", January 1980

No. IV - 2 Lyn Snuffer, "Rural Women: An Annotated Caribbean Bibliography with special reference to Jamaica", January 1980

No. IV - 3 Vincent Campbell, Abdul Wahab, Howard Murray, "Response of Peanut (Arachis hypogaea L.) on a Newly Terraced Ultisol in Jamaica", January 1980

No. IV - 4 P. Aitken, A. Wahab, I. Johnson, A. Sahni, "Agro-Socio-Economic Survey - Pilot Hillside Agricultural Project 'PHILAGRIP' Southern Trelawny," February, 1980

No. IV - 5 Glenys H. Barker, "Bibliography of Literature relating to Research and Development in the Agricultural Sector of Jamaica 1959 - 1979", March 1980

No. IV - 6 Milton R. Wedderburn, "Allsides Farmers' Pre-Cooperative A Socio-Economic Assessment", March 1980

No. IV - 7 Adele J. Wint, "The Role of Women in the Development Process", April 1980

No. IV - 8 Milton R. Wedderburn, "The Co-operative Input in the Development of the Pilot Hillside Agricultural Project (PHILAGRIP)", April 1980

No. IV - 9 MOJ/IICA/CARDI, Fruit Trees Seminar -"Research & Development of Fruit Trees", June 1980

No. IV - 10 Henry Lancelot, "Traditional Systems in Hillside Farming, Upper Trelawny, Jamaica", June 1980

No. IV - 11 IICA/Jamaica, "Pilot Hillside Agricultural Project", (PHILAGRIP), Project Document. Vols. I, II and III, June 1980

No. IV - 12 A. Wahab, I. Johnson, P. Aitken, H. Murray and H. Stennett, "Highlights of the Pilot Hillside Agricultural Project at Allsides", July 1980

No. IV - 13 I. Johnson, A. Wahab, P. Aitken, H. Payne, "Benchmark for a Project Profile for Developing a Peanut Industry in Jamaica", July 1980

No. IV - 14 P. Aitken, A. Wahab, I. Johnson, "The Allsides Post Peasant", August 1980

No. IV - 15 Norma Munguia, Percy Aitken, Abdul Wahab, Irving Johnson, "Salt Extraction by Solar Energy", A Mini-project, September 1980

No. IV - 16 Abdul H. Wahab, Percy Aitken-Soux, Irving E. Johnson and Howard Murray, "The Allsides Project in Jamaica - Developmental Potentials of Hillside Agriculture", September 1980

No. IV - 17 P. Aitken, A. Wahab, I. Johnson, A. Sahney and N. Munguia, "Rural Women Survey", Vols. I, II and III, October 1980

No. IV - 18 P. Aitken, I. E. Johnson, A. Wahab, "Assessment of Employment Among Small Hillside Farmers of Jamaica", November 1980

No. IV - 19 IICA/Jamaica "Pilot Hillside Agricultural Project", (PHILAGRIP), Final Project Document. October 1980.

No. IV - 20 P. Aitken, A. Wahab, I. E. Johnson, Bo-Myeong Woo, "IICA Evaluation of the First Phase FSB Allsides Project", (Internal Document of Work), November 1980

No. IV - 21 MINAC/IICA/CARDI - "Seminar on Multiple Cropping", December 1980

1981

No. V - 1 N. Munguia, P. Aitken, A. Wahab, I. Johnson, "Smoke Curing of Fish (as a household industry in Rural Jamaica)", January 1981

No. V - 2 P. Aitken, A. Wahab, I. Johnson, "Under-employment - It's Relation to the Agricultural Sector and Considerations for its Management", January 1981

No. V - 3 D. D. Henry, J. R. Gayle, "The Culture of Grafted Pimento (as spice crop for Allsides, Jamaica)", January 1981

No. V - 4 Abdul H. Wahab, Noel Singh, "Agricultural Research in Jamaica", February 1981

No. V - 5 P. Aitken-Soux, A. H. Wahab, I. E. Johnson, "Country Level Action Plan (CLAP)", May 1981

No. V - 6 P. Aitken-Soux, A. H. Wahab, I. E. Johnson, "Overview of Agricultural Development in Jamaica", May 1981

No. V - 7 Samuel Thompson, I. E. Johnson, P. Aitken-Soux, Abdul Wahab, "The Land Development & Utilization Act 1966", July 1981

No. V - 8 Abdul Wahab, Percy Aitken-Soux, Irving Johnson, Bo-Myeong Woo, Howard Murray, Joseph Dehaney, "The Experiences of Jamaica in the Management of Agricultural Production on Hillsides", July 1981

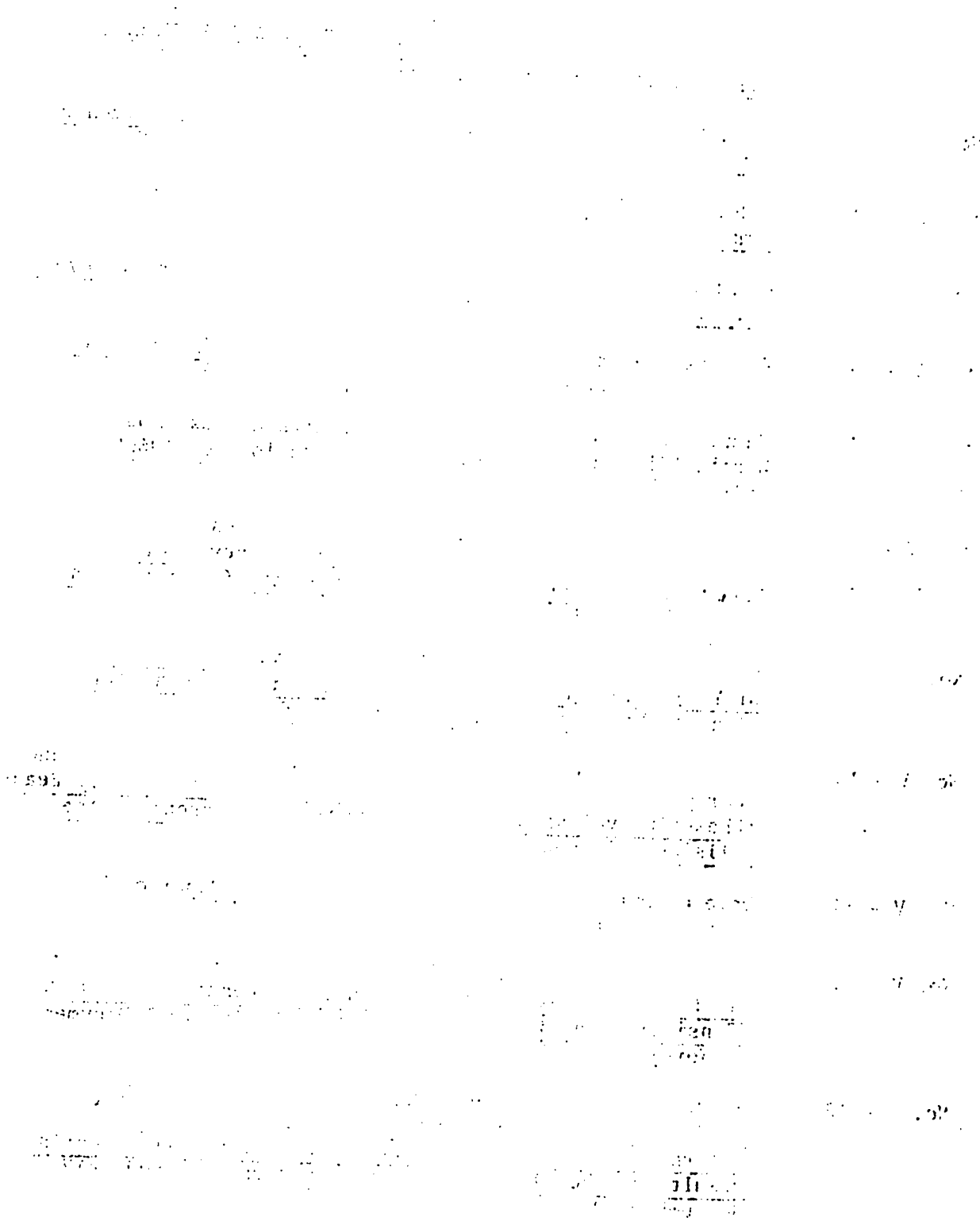
No. V - 9 Dave Hutton, Abdul Wahab, Howard Murray, "Yield Response of Yellow Yam (Dioscorea Cayenensis) After Disinfesting Planting Material of Pratylenchus Coffeae", July 1981

No. V - 10 Elaine Montague-Gordon, Abdul H. Wahab, Joseph Dehaney and Audrey Wright, "Performance of Eleven Varieties of Dry Beans (Phaseolus vulgaris) Over Two Successive Seasons on the Hillsides of Jamaica", August 1981

No. V - 11 Dave G. Hutton, Abdul H. Wahab, "Position Paper on Root Crops in Jamaica", August 1981

No. V - 12 Percy Aitken-Soux, Abdul H. Wahab, Irving E. Johnson, "Technical Assistance for the English Speaking Caribbean (Considerations for an IICA Strategy)" (Internal Document of Work), September 1981

No. V - 13 Bo-Myeong Woo, Abdul H. Wahab, Joseph Dehaney, "Crop Production on Hillsides using non-Bench Terracing Alternative Measures for Soil Conservation (first year's results of the Olive River Soil Conservation studies)", September 1981



No. V - 14 Abdul H. Wahab, Percy Aitken-Soux, Irving E. Johnson, Bo-Myeong Woo, Howard Murray and Joseph Dehaney, "Agricultural Production on Hillsides - the Allsides Project Case Study", September 1981

No. V - 15 D. G. Hutton, A. H. Wahab and J. Dehaney, "Investigating Critical Levels of Dry Rotting of Yellow Yam (Dioscorea Cayenensis) Planting Material, the Benefits of Disinfesting the Heads of Pratylenchus Coffeae and of After-Planting Nematicide Treatments", September 1981

No. V - 16 D. G. Hutton, A. H. Wahab, H. Murray and J. Dehaney, "Critical Levels of Dry Rotting of Yellow Yam (Dioscorea Cayenensis) Planting Material and Yield Responses After Disinfesting Heads of Pratylenchus Coffeae and After Post-Plant Nematicide Applications", September 1981

No. V - 17 E. Ayer and J. Reyes, "Seminar on Mediterranean Fruit Fly", September 30, 1981

No. V - 18 Bo-Myeong Woo, "Erosion Control Works in Korea", October 1981

No. V - 19 Irving E. Johnson and Percy Aitken-Soux, "Country Level Action Plan (CLAP)" (Third Revision - Internal Document of Work), October 1981.

No. V - 20 Humberto Pizarro, "Programme of Work to Establish Guidelines for the Effective Administration, Operation and Maintenance of the Irrigation and Drainage District in the BRUMDEC Project" November 1981

No. V - 21 Humberto Pizarro, "The Operation of the Drainage System in the Black River Upper Morass Project", November 1981

No. V - 22 Humberto Pizarro, "Recommendations for Land Use and Irrigation Needs in the BRUMDEC Project", November 1981

No. V - 23 Humberto Pizarro, "Organization, Operations and Maintenance of the Irrigation System in the BRUMDEC Project", November 1981

No. V - 24 Humberto Pizarro, "Basic Information for Planning Water Management in the BRUMDEC Project", November 1981

1982

No. VI - 1 Vivian Chin, "Rice Research and Production in the BRUMDEC Project State-of-the-Art Review, Identification of Constraints and Interim Recommendations and Budget for Establishing 405 Hectares (1,000 acres) of Rice on the Clay Soils at BRUMDEC", January 1982

No. VI - 2 Vivian Chin, "Programme of Work for the Short-Term Adaptive Production-Oriented Research on Rice in the BRUMDEC Project", January 1982

No. VI - 3 Claude Grand-Pierre, "Adaptive Research for Grain Production (BRUMDEC) - A Short-Term Programme", January 1982

No. VI - 4 Claude Grand-Pierre, "Experimental Procedures for Grain Crops Research in the BRUMDEC Project", January 1982

No. VI - 5 Charles Kennard, "Summary of the Proposed Programme of Work for Adaptive Production Oriented Research (Short-Term) in Vegetable Production in the BRUMDEC Project", January 1982

No. VI - 6 Charles Kennard, "Vegetable Production (BRUMDEC) - Review and Proposed Short-Term Adaptive Production Oriented Research Programme", January 1982

No. VI - 7 Bo-Myeong Woo, "Olive River Run-Off Plots - Description of the Experiment", January 1982

No. VI - 8 Vivian Chin, "Fertilizer Experiments in BRUMDEC (Second Quarterly Report)", January 1982

No. VI - 9 Claude Grand-Pierre, "Third Quarterly Report of the Short Term Production Oriented Sorghum Research Programme", January 1982

No. VI - 10 Bo-Myeong Woo, Ministry of Agriculture, "Crop Production on Hillsides Using Non-Bench Terracing Alternative Measures for Soil Conservation", February 1982

No. VI - 11 Philemon Hoilett, Ina Pyne, Calvin Gray, Ronford Baker, and Michel Eldin, "Workshop on Agroclimatic Zoning - case study Kingston, Jamaica", April 1982

No. VI - 12 Charles Kennard, "Vegetable Production Programme - BRUMDEC Second Quarterly Report", Period December 19, 1981 - March 18, 1982, April 1982

No. VI - 13 Claude Grand-Pierre, "Final Report on Grain Experimental Work in BRUMDEC", (Contract I), May 1982

No. VI - 14 J. Y. Richmond, Ph.D., "Lab Safety Seminar - Animal Health - Conferences of Jonathan Richmond", June 1982

FECHA DE DEVOLUCION			