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**ADAPTIVE RESEARCH FOR  
GRAIN PRODUCTION (BRUMDEC)  
(A Short Term Programme)**

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**IICA/JAMAICA**

**Miscellaneous Publication #317**

**ISSN-0534-5391**

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GRAIN PRODUCTION (LITMIDC)  
IN AGRICULTURAL PROGRAMS

1974

IN AMERICA  
International Publication # 811  
1987-0529-2391

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Instituto Interamericano de Documentación  
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1981  
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ADAPTIVE RESEARCH FOR GRAIN PRODUCTION (BRUMDEC)

(A SHORT TERM PROGRAMME)

BY

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BIBLIOTECA VENEZUELA  
1981

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January 1981

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ADAPTIVE RESEARCH FOR GRAIN PRODUCTION (BRUMDEC)

( A SHORT TERM PROGRAMME)

Claude Grand-Pierre  
Grain Production Specialist  
IICA Consultant

1. INTRODUCTION

The Black River Upper Morass Development Company Limited (BRUMDEC) is the legally authorized executing agent of the Black River Morass Reclamation Project. The Project is concerned with the development of approximately 4,451 ha (11,000 acres) of land in the Elim and Barton Isle areas of St. Elizabeth, and the company plans to cultivate the following crops: onions, peas and beans, rice, corn, pineapple, cassava, mango, citrus, sugar cane, coffee, vegetables, plantain and peanuts.

One of the objectives of the BRUMDEC includes: the initiation of Research and Development for introducing improved agricultural production techniques and to provide technical assistance to farmers in the area. As a consequence, BRUMDEC has signed on the 19th December 1980, an agreement with the Inter-American Institute for Co-operation on Agriculture - (IICA) for the provision of five (5) consultants in the area of :-

- (a) rice production
- (b) grain crop production
- (c) vegetable crop programme
- (d) irrigation and drainage management; and
- (e) farmers organization.

In relation to grain crop production, the Grain Production Specialist is expected to prepare a short term programme of Adaptive Research for Grain Crop Production with the objective of determining the most economic cropping pattern aimed at solving the problems which obtain in grain production with special reference to corn, sorghum and legumes under the conditions of the Project Area of BRUMDEC. To this end cereals and grain legumes will be produced on trial plots to identify important production constraints and to suggest and recommend ways of removing these constraints.

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In this context a programme of adaptive research is herewith *propOsed*.

## 2. BACKGROUND

In order to develop a viable system of agricultural production for a given area it is imperative that an examination be made of Agro-climatic factors: such as weather, and water resources, financial, physical and human resources. For this reason a discussion of these parameters is relevant.

### 2.1 Location

The Black River Morasses are divided into the Upper Morass and the Lower Morass. They are situated in the Western part of Jamaica near the south coast in the parish of St. Elizabeth. The Upper Morass area envisaged for agricultural development by BRUMDEC is situated between Maggoty in the north and Lacovia in the south. It consists of approximately 4,451 hectares (11,000 acres) of land. The Lower Morass extends from Middle Quarters in the north to the Black River Bay in the south and covers a much greater area than the Upper Morass. A more detailed presentation on the location of the Morasses appears in chapter one of the detailed report titled "Black River Morasses Reclamation Project". (2)

### 2.2 Climatic Conditions

#### (i) Rainfall

The climatic conditions of the Project Area have been reported on in detail. (2) Presented in Table I are figures of average annual rainfall, and evapo-transpiration of the Upper Morass area. As indicated there are two distinct rainy seasons viz; April through May and August through October. The drier months are, December, January and February where potential evapo-transpiration exceeds rainfall. The months of heaviest rainfall are May and October:

In this context a program of sensitive research is being proposed.

2.1.1.1

In order to develop a viable system of agricultural production for a given area it is imperative that an evaluation be made of agro-climatic factors such as weather, soil, water resources, physical and human resources. For this reason a discussion of these parameters is relevant.

2.1.1.2

The 1000 acre project area is divided into the Upper Terrace and the Lower Terrace. They are located in the Western part of the project area near the road to the north of St. Elizabeth. The Upper Terrace was established for agricultural development by I.C.P.A.D. It is situated between the 1000 acre north and south in the center. It consists of approximately 4,251 acres (11,000 acres) of land. The Lower Terrace extends from the Upper Terrace to the north to the River Bank in the south and covers a much greater area than the Upper Terrace. A more detailed presentation on the location of the Terrace systems is given in chapter one of the detailed report titled "The River Terrace Reclamation Project". (S)

2.1.1.3

(a) Rainfall

The climate conditions of the project area have been reported on in detail in the report titled "The River Terrace Reclamation Project". (S) The annual rainfall and evapotranspiration of the project area are as follows: Annual rainfall is 1000 mm and evapotranspiration is 1000 mm. The difference between rainfall and evapotranspiration is 0 mm. The project area is a semi-arid area and the rainfall is low. The project area is a semi-arid area and the rainfall is low. The project area is a semi-arid area and the rainfall is low.



	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Average rainfall	58.4	81.2	108.9	221.9	<u>275.3</u>	139.7	125.9	234.9	220.4	<u>342.6</u>	165.1	76.9
Evapotranspiration	<u>84.0</u>	<u>87.8</u>	105.6	114.3	124.9	110.9	125.4	114.5	91.9	91.1	77.4	<u>80.5</u>

Source: Black River Morasses Reclamation Project GOJ(MAL) GRONTMIJ Consulting Company of the Netherlands, 1964

This rainfall pattern will to a large extent determine the future rotation programme for Grain Production in the area.

(ii) Temperature

There are no temperature records for the area but it is unlikely that the St. Elizabeth plains will differ significantly from the generally accepted pattern for the coastal plains of Jamaica. From statistics available for the coastal plains the temperature ranges are as follows:

	Hottest Month	Coollest Month
Average daily maximum	32.8 C (91F)	26.1 C (79F)
Average daily minimum	21.1 C (70F)	16.7 C (62F)

(iii) Humidity

Again there are no humidity records for the project area. Records for other coastal areas of the island indicate that humidity is very high during the night but drops rapidly during the day and reaches a minimum at about 3 P.M. This overall pattern can change by rain falling during the day.

Year	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June
1951	81.2	81.2	81.2	81.2	81.2	81.2	81.2	81.2	81.2	81.2	81.2	81.2
1952	81.2	81.2	81.2	81.2	81.2	81.2	81.2	81.2	81.2	81.2	81.2	81.2

Source: Black River Watershed Administration Project 800 (WAL) (1951-52)  
 Courtesy of the author, 1954

This rainfall data will to a large extent determine the future  
 rotation program for grain production in the area.

(ii) Temperature

There are no temperature records for the area as it is unlikely  
 that the St. Elizabeth station will suffer significantly from the  
 generally prevailing conditions for the coastal plains of Jamaica. From  
 statistics available for the coastal plains the temperature records  
 are as follows:

Temperature	Hottest Month	Cooltest Month
Average daily maximum	31.1 C (88 F)	25.1 C (77 F)
Average daily minimum	21.1 C (70 F)	16.7 C (62 F)

(iii) Humidity

There are no humidity records for the project area. Records  
 for other parts of the island indicate that humidity is very  
 high during the wet season, but drops rapidly during the dry season  
 a minimum of 20% humidity is maintained. Humidity can change by  
 falling during the day.

## 2.3 Major Soil Types in the Project Area

### 2.3.1 Morass Peat Soil No. 152

This soil is most widespread in the project area and is derived under swamp conditions from sawgrass, Claudium jamaicense and other related sedges. Depending on the level of the water table solid black peat forms a mat on the surface which overlies rotting vegetation mixed with water to depths which vary from 0.30m to over 2.10m until bluish grey clay and sandy clay is encountered. (3)

As shown in Table 2 the soil reaction of Morass Peat is slightly acidic (pH 6.4). Levels available  $P_2O_5$  are medium (71ppm) whereas exchangeable potash is very low (58 ppm) for adequate crop growth. Exchangeable magnesium appears adequate (670 ppm) but calcium is strikingly high (7,643 ppm). It is very possible that such a high calcium level may result in induced deficiencies of manganese, iron and zinc. Soil management studies conducted on peaty soils in the Everglades of Florida indicate that the judicious use of trace elements coupled with good pest management can result in satisfactory yields of cereal and vegetable crops. (5)

### 2.3.2 Four Paths Series of Soils

Four Paths Clay - 203 - Four Paths Loam - 204

These soils are the second most widespread within the project area. They are highly weathered and strongly leached. As presented in Table 2 they are highly acidic (pH. 5.4) deeply and infertile for the most part. (3)

Four Paths Clay - 203 consists of a deep layer of friable top-soil. Although highly acidic and infertile (Table 3) this soil would support adequate crop growth if well managed.

Four Paths Sandy Loam - 204 may be regarded as the most infertile in the project area due to the fact that the highly mottled and poorly drained sub-soil is covered by a thin layer of sand or gravel. (3)

Section 1.5

Section 1.5

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2.3.3 Wallens Clay - 9A

The parent material of Wallens Clay in the Project area is yellow alluvial material. Phosphate is low in some areas whereas in others it is adequate. That this is so is a reflection of the use of fertilizer on rice and sugar cane. Potash is generally low, while magnesium levels are adequate. (Table 2).

2.3.4 Cashew Clay Loam - 151

This soil is acidic, heavy textured and may be regarded as being of low fertility (Table 2). Phosphate and potash are very low and inadequate for most crops. Calcium and magnesium are adequate and no lime application are needed on this soil. (3)

Soil types	Depth cm	pH	Phos- phate ppm K <sub>2</sub> O	Phos- phate ppm P <sub>2</sub> O <sub>5</sub>	Magnesium ppm Mg	Calcium ppm Ca	% Organic matter
Morass Peat - 151	0-45	6.4	70.5	58.0	668.6	7,643	29.1
Four Paths Clay- 203	0-45	5.4	63.0	27.2	94.8	670	3.0
Four Paths Sandy Loam - 204	0-45	5.1	33.2	30.0	118.2	722	3.1
Wallens Clay- 9A	0-45	7.4	70.5	58.3	463.1	5,643	3.5
Cashew Clay Loam -151	0-45	6.3	36.2	43.4	223.7	3,070	2.9

Source: Report on the detailed soil survey of the Upper Morass (3)

2.7.3 Methods of

The present study is a part of a larger project which is being carried out in the field of soil science. The main objective of the study is to determine the effect of different soil treatments on the growth and yield of various crops. The results of the study are presented in the following tables (Table 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100).

2.8.4 Statistical analysis

The data obtained from the field experiments were analyzed statistically using the methods described in the following sections. The results of the statistical analysis are presented in the following tables (Table 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100).

TABLE 1		Yield of various crops (kg/ha)				
Treatment	Wheat	Maize	Soybean	Groundnut	Mustard	Barley
T1	12.5	18.2	15.1	10.3	8.7	11.4
T2	13.1	19.5	16.3	11.2	9.5	12.1
T3	14.2	20.8	17.4	12.1	10.3	13.2
T4	15.3	22.1	18.5	13.2	11.4	14.3
T5	16.4	23.4	19.6	14.3	12.5	15.4
T6	17.5	24.7	20.7	15.4	13.6	16.5
T7	18.6	26.0	21.8	16.5	14.7	17.6
T8	19.7	27.3	22.9	17.6	15.8	18.7
T9	20.8	28.6	24.0	18.7	16.9	19.8
T10	21.9	29.9	25.1	19.8	18.0	20.9

TABLE 1: Yield of various crops (kg/ha) under different treatments.

## 2.4 Drainage and irrigation facilities

The present situation existing in the Upper Morass is characterized by periodic inundations caused by the Black River in the wet seasons. As a consequence the land suffers from increasingly inadequate removal of the ground water and rain water. To remedy this situation the actual drainage construction would start in September 1979 and is currently in progress. A contract for the irrigation design was signed on January 1980 and according to available information, surveying work for the actual design of the irrigation works is completed and the actual work is in progress. (1)

## 2.5 Financial Aspects

The project was initially estimated to cost US\$18.5 million with all ultimate construction/development elements estimated to cost US\$15.0 million including equipment, contingencies and escalation. But the up-dated budget of the project has an estimated total cost of US\$30.5 million while the approved available financial resources is US\$18.5 million comprising of : (1)

	<u>US\$</u>
IDB Loan	12.5M
OPEC Loan	3.0
GOJ Contributuon	3.0

## 2.6 Physical and human resources

In consonance with the projected staffing arrangements BRUMDEC is not yet fully staffed. Presently the key personnel employed on the project are as follows:

- The Project Manager
- The Administrative Officer
- Farm Superintendent (presently counterpart to the Rice Consultant)
- Crop Production Officer (presently counterpart to the Grain Production Consultant)
- Rice Production Specialist (IICA/Consultant)
- Grain Crop Production Specialist (IICA/Consultant)





A workshop is utilized for the maintenance of pumps, irrigation, cultivation, drainage and harvesting equipment and service vehicles.

Present BRUMDEC activities in crops production are as follows:

- Rice approximately	200 ha
- Coffee "	4 ha
- Mango "	7 ha
- Avocado "	3.5 ha
- Pineapple "	12 ha
- Cassava "	12 ha

### 3. OBJECTIVES OF THE PROGRAMME OF ADAPTIVE RESEARCH FOR GRAIN PRODUCTION

On the basis of the parameters reviewed above cereals and grain legumes will be produced on a series of trial plots to identify production constraints and to suggest and recommend ways of removing these constraints. To this end a programme of adaptive research is proposed initially to determine:

- 3.1 Factors limiting production of grain cereals and legumes;
- 3.2 The ideal technological practice for each crop with respect to each soil type.

### 4. METHODOLOGY

The agronomic research and testing proposed is an adaptation of the CIMMYT Procedure (4) which is aimed at developing in the shortest possible time improved practices for increasing yields and net income of different crops.

The initial field work is conducted in a sequence of two steps i.e., testing of and fitting of appropriate technological alternatives for commercial grain crop production.

#### 4.1 Step 1

Various trials are established to determine the limiting factors to grain crop production in the project area. Emphasis is placed on experiments which will identify critical management factors ( in terms of priority and interactions) and to detect factors of production which

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have the highest impact on cost/benefits and simultaneously which will find a high degree of acceptance by producers.

The field data obtained from this step will supply the information needed to determine those factors which are economically relevant and which must be considered in the experiments programmed for the next step.

#### 4.2 Step 2

In this step, experiments are designed specifically to evaluate the effects of different levels of those critical factors which were identified in step one. Emphasis is placed on experiments which are aimed at quantifying the agro-economic response to each critical management factor. Ancillary trials will be established to identify inter alia appropriate pesticides and herbicides, and appropriate tillage methods and levels; optimum crop density and optimum fertilizer levels. Data from these studies will be used in the :

- (i) formulation of technological alternatives (packages) with different levels of benefits and associated risks;
- (ii) partial budget analysis of agronomic data; and
- (iii) spectrum of relevant economic factors to be considered for future long-term trials.

### 5. Grain Crops envisaged

#### 5.1 Grain cereals component

The grain cereal components will include corn and sorghum.

#### 5.2 Legume component

Initially the studies will be confined to cowpea. During the second phase Pigeon Pea, Red Pea and Peanut will be considered as well as cowpea.

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## 6. Trials proposed during Phase One

### 6.1 Relevance of production factors trial

#### Objectives

- To identify the most critical production factors under the project area conditions of BRUMDEC.
- To determine the effect of withholding one practice from the complete set of basic production practices.

#### Treatments

In each plot the Basic Production Package (BPP) is applied or the BPP minus one factor. The BPP consists of (x) kg N/ha + (y) kg  $P_2O_5$ /ha + (w) kg  $K_2O$ /ha + improved variety + optimum density + use of herbicide + use of insecticide + (g) micro-elements (Table 4)

<u>Treatment</u>	<u>Inputs</u>
1	BPP (all factors applied)
2	BPP-N (no N applied)
3	BPP-P (no P applied)
4	PPP-K (no K applied)
5	BPP-M.E. (no Micro-elements applied)
6	BPP-I (no insecticide applied)
7	BPI-H (no herbicide applied)
8	BPP-D (2) (other population density)
9	V only (no N,P,K,M,E,H. or I used)

#### Experimental Design

A randomized complete Block Design having 4 replications.

#### Plot Size

Com : Six (6) row, 10m long with 0.80m between rows and 0.50m between hills.

Sorghum: Six (6) rows, 10m long with 0.80m between rows and 0.06m between plants (18 plants per linear meter).

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8/15/54	Balance forward of 1954	0.00
8/15/54	Interest on 1954	0.00
8/15/54	Interest on 1954	0.00
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Cowpea: Six (6) rows, 10m long with 0.45m between rows and 0.09m between plants (12 plants per linear meter).

TABLE 4 : Basic Production Package for each crop (Fertilizer regime)

INPUTS	CORN	SORGHUM	COWPEA
Kg N/Ha	100	100	50
Kg P <sub>2</sub> O <sub>5</sub> /Ha	80	80	80
Kg K <sub>2</sub> O/Ha	80	80	80
Kg FTE-BR 12 (Micro-elements)	20	20	20
Density-Plants/ha (1)	50,000	222.000	245.000
Density-Plants/ha (2)	25.000	140.000	155.000

## 6.2 Basic Fertilizer Experiment

### Objectives

- To compare the yield response due to four different fertilizer nutrients under the Project area conditions
- To identify significant interactions between fertilizer nutrients.

A - Nitrogen (N)	N <sub>1</sub> (X <sub>1</sub> ) Kg N/Ha
	N <sub>2</sub> (X <sub>2</sub> ) Kg N/Ha
B - Phosphorus (P)	P <sub>1</sub> (Y <sub>1</sub> ) Kg P <sub>2</sub> O <sub>5</sub> /Ha
	P <sub>2</sub> (Y <sub>2</sub> ) Kg P <sub>2</sub> O <sub>5</sub> /Ha
C - Potash (K)	K <sub>1</sub> (z <sub>1</sub> ) Kg K <sub>2</sub> O/Ha
	K <sub>2</sub> (z <sub>2</sub> ) Kg K <sub>2</sub> O/Ha
D - Micro-elements (FTE-BR12)	M.E <sub>1</sub> (w <sub>1</sub> ) Kg M.E/Ha
	M.E <sub>2</sub> (w <sub>2</sub> ) Kg M.E/Ha

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TREATMENTS	CORN	SORGHUM	COWPEA
N <sub>1</sub>	50 Kg N/ha	50 Kg N/ha	50 Kg N/ha
N <sub>2</sub>	100 Kg N/ha	100 Kg N/ha	100 Kg N/ha
P <sub>1</sub>	50 Kg P <sub>2</sub> O <sub>5</sub> /ha	50 Kg P <sub>2</sub> O <sub>5</sub> /ha	50 Kg P <sub>2</sub> O <sub>5</sub> /ha
P <sub>2</sub>	100 Kg P <sub>2</sub> O <sub>5</sub> /ha	100 Kg P <sub>2</sub> O <sub>5</sub> /ha	100 Kg P <sub>2</sub> O <sub>5</sub> /ha
K <sub>1</sub>	50 Kg K <sub>2</sub> O/ha	50 Kg K <sub>2</sub> O/ha	50 Kg K <sub>2</sub> O/ha
K <sub>2</sub>	100 Kg K <sub>2</sub> O/ha	100 Kg K <sub>2</sub> O/ha	100 Kg K <sub>2</sub> O/ha
M.E.	15 Kg FTE/ha	15 Kg FTE/ha	15 Kg FTE/ha
M.E.	30 Kg FTE/ha	30 Kg FTE/ha	30 Kg FTE/ha

### Experimental Design:

This experiment is a randomized complete block design with 3 replications. The plots are arranged as a 2<sup>4</sup> factorial in blocks of 8 treatments with the 4 factor interaction confounded with blocks.

### PLOT SIZE

- Corn : Six (6) rows, 10m long with 0.80m between rows and 0.50m between hills.
- Sorghum : Six (6) rows, 10m long with 0.80m between rows and 0.06 between plants.
- Cowpea : Six (6) rows, 10m long with 0.45m between rows and 0.09m between plants.

There are two (2) experiments for each crop (3) in each soil types (4) for a total of twenty four (24) trial plots in the step one. The experiments in the second step are designed specifically to evaluate the effects of using different levels of those critical factors which were identified in step one. The experimental results determine the best varieties, plant population, optimum

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Mr. S. K. Brown	101 Elm St.	555-3456
Mr. M. N. Green	202 Cedar St.	555-7890
Mr. P. Q. Black	303 Birch St.	555-2345
Mr. D. E. Gray	404 Spruce St.	555-6789
Mr. G. H. Blue	505 Willow St.	555-0123
Mr. I. J. Red	606 Ash St.	555-4567
Mr. K. L. Purple	707 Hickory St.	555-8901
Mr. M. O. Yellow	808 Sycamore St.	555-2345
Mr. N. P. Pink	909 Magnolia St.	555-6789
Mr. Q. R. Orange	1010 Dogwood St.	555-0123

Official Statement

The undersigned hereby certifies that the above is a true and correct copy of the records of the office of the undersigned.

W. J. Smith

Notary Public for the State of New York  
My Commission Expires on 12/31/2024  
I hereby certify that the above is a true and correct copy of the records of the office of the undersigned.

Notary Public for the State of New York  
My Commission Expires on 12/31/2024  
I hereby certify that the above is a true and correct copy of the records of the office of the undersigned.

fertilizer levels and application rate of herbicides and insecticides. The object is to find the optimum economic rates for inputs and to determine the ideal technological practice for each crop in respect to each soil type, considering:

- A - the inherent nutritional status of the soil; and
- B - the nutritional crop requirement for satisfying genetic yield potential.

On the basis of the information supply by the experimental results in step one, the following plot trials are envisaged:

### 6.3 Fertilizer Experiment

#### Objectives

To determine an optimum economic fertilizer rate under the Project Area conditions.

### 6.4 Weed Control Experiment

#### Objectives

To determine the effectiveness of two or three herbicides in crop protection and to assess the economic benefits of weed control with herbicides.

### 6.5 Insect Control Experiment

To compare the effectiveness of two or three insecticides on crops grown under conditions of the Project area and to assess the economic benefits of crop protection with insecticides.

### 6.6 Variety X Density Experiment

#### Objectives

To compare hybrids and/or promising commercial or experimental varieties and to examine the interactions between these varieties and crop population densities.

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6.7 Pre-verification Trial

Objectives

To observe a range of improved practices for increase yields and net income.

7. PERSONNEL

The personnel required for the programme are as follows:

One (1) Grain Production Officer (BRUMDEC's Counterpart)

Three (3) Technicians

Fifteen (15) workers

8. LAND

Three (3) acres in the Morass Peat

Three (3) acres in the Wallens Clay

Three (3) acres in the Four Path Clay

Three (3) acres in the Cashew Clay

9. MATERIALS\* and EQUIPMENT

(see list in Annex 1)

\* Materials only for STEP 1

10. CHRONOGRAM OF ACTIVITIES (TENTATIVE)

(See Annex 2)

11. FIELD OFFICE FACILITIES

Facilities must be offered for implementation and maintenance of the programme.

12. REMARKS

As a consequence of limited time and the present rainfall situation there will probably be a significant gap between the planning schedule and execution work if the land preparation, personnel and materials

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are not ready at end of June. On such an occasion the first trials will be established in August and the step two (2) will be in December.

REFERENCE

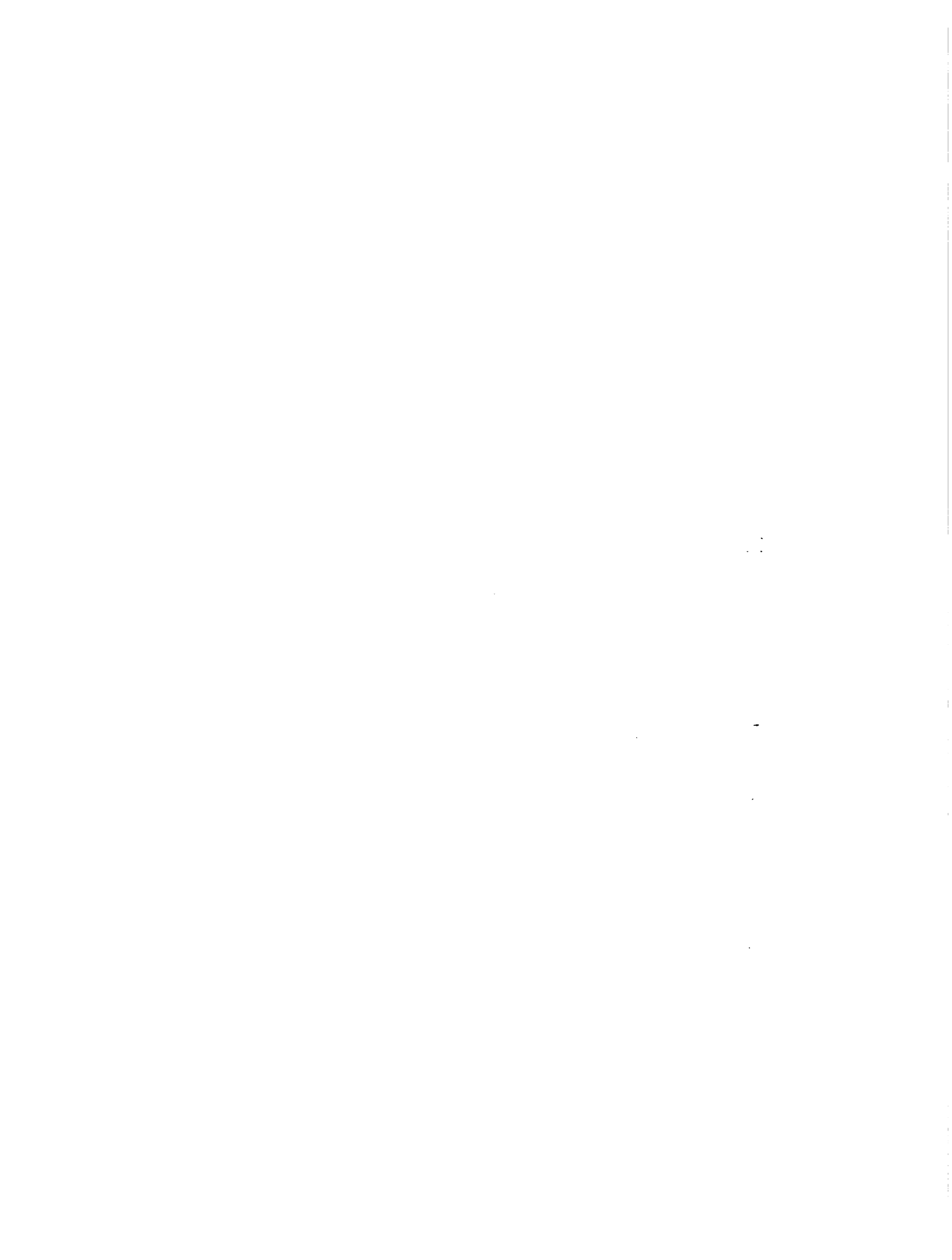
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3. - Report on the detailed Soil Survey of the Upper Morass, March 1978
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ANNEX 1LIST OF PRODUCTS (STEP 1)

Items	Quantity	Cost
Corn: Pioneer x 304 A	30 lbs.	
Sorghum: Pioneer 8244	30 lbs.	
Cowpea: African Red Variety	60 lbs.	
Other seeds: Peanuts, Pigeon Peas		
<u>Fertilizers:</u>		
Urea (45%)	90 Kg	
Triple Superphosphate (40-50%)	150 Kg	
Sulphate of Potash (48%)	165 Kg	
FTE-BR 12 (free trace elements)	45 Kg	
<u>Insecticides and Fungicides:</u>		
Furadan (5% a.i.)	30 Kg	
Sevin 80% W.P.	30 Kg	
Diazinon	15 Lt.	
Benlate	30 lbs.	
<u>Herbicides:</u>		
Gesaprim - Combi 80	8 Kg	
Probe	8 Kg	



LIST OF MATERIALS

Items	Quantity	Cost
Wooden Stakes	500	
Hammer or Striker	4	
Strings (333 ft.)	3	
Measuring Tape (30 cm)	3	
Measuring Cups (250 cc)	30	
Plastic Cans (20 Lt.)	15	
Knapsack Sprayers	10	
Graduated Plastic Cylinder (1000 ml)	5	
Graduated Plastic Cylinder (100 cc)	5	
Moisture Meter	1	
Burrow Gram Scale (triple beam)	1	
Soil Moisture Meter	1	
Soil Auger	1	
Rakes	10	
Hoes	15	
Machetes	15	
Buckets (20 lt.)	15	
Plastic Bags (40 x 20 cm)	300	
Tags (a lot of Marking Pencils)	10	
Field Books	30	
Stapler	6	
Wooden Marking Frame 2" x 1" with four (4) divisions	2	







## AGRICULTURE IN JAMAICA

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1977 - 1978

- No. I - 1 Fritz Andrew Sibbles, "Basic Agricultural Information on Jamaica Internal Document of Work", January 1977
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- No. III - 4 IICA Jamaica Staff, "Agro-Socio-Economic Sample Survey of Allsides - Trelawny, Jamaica", September 1979

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that this is essential for ensuring transparency and accountability in the organization's operations.

2. The second part of the document outlines the various methods and tools used to collect and analyze data. It highlights the need for consistent data collection procedures and the use of advanced analytical techniques to derive meaningful insights from the data.

3. The third part of the document focuses on the role of technology in data management and analysis. It discusses how modern software solutions can streamline data collection, storage, and processing, thereby improving efficiency and accuracy.

4. The fourth part of the document addresses the challenges associated with data management, such as data quality, security, and privacy. It provides strategies to mitigate these risks and ensure that data is handled in a responsible and secure manner.

5. The fifth part of the document concludes by summarizing the key findings and recommendations. It stresses the importance of a data-driven approach in decision-making and the need for continuous monitoring and improvement of data management practices.

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

1. The first part of the document discusses the general principles of the project.

2. The second part of the document discusses the specific details of the project.

3. The third part of the document discusses the results of the project.

4. The fourth part of the document discusses the conclusions of the project.

5. The fifth part of the document discusses the future work of the project.

6. The sixth part of the document discusses the acknowledgments of the project.

7. The seventh part of the document discusses the references of the project.

8. The eighth part of the document discusses the appendices of the project.

9. The ninth part of the document discusses the index of the project.

10. The tenth part of the document discusses the glossary of the project.

11. The eleventh part of the document discusses the bibliography of the project.

12. The twelfth part of the document discusses the list of figures of the project.

13. The thirteenth part of the document discusses the list of tables of the project.

14. The fourteenth part of the document discusses the list of abbreviations of the project.

15. The fifteenth part of the document discusses the list of symbols of the project.

16. The sixteenth part of the document discusses the list of units of the project.

17. The seventeenth part of the document discusses the list of acronyms of the project.

- 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
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- No. IV - 15 Norma Munguia, Percy Aitken, Abdul Wahab, Irving Johnson, "Salt Extraction by Solar Energy", A Mini-project, September 1980
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- 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
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1. The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that proper record-keeping is essential for the integrity of the financial system and for the ability to detect and prevent fraud.

2. The second part of the document outlines the various methods used to collect and analyze data. It describes the use of statistical techniques to identify trends and anomalies in the data, and the importance of using reliable sources of information.

3. The third part of the document discusses the role of the auditor in the process. It explains that the auditor's primary responsibility is to provide an independent and objective assessment of the financial statements, and to ensure that they are prepared in accordance with the applicable accounting standards.

4. The fourth part of the document discusses the importance of communication in the auditing process. It explains that the auditor must maintain open and effective communication with the client, and must be able to clearly and concisely communicate the results of the audit.

5. The fifth part of the document discusses the importance of ethics in the auditing profession. It explains that auditors must adhere to a strict code of ethics, and must be able to resist pressure from the client to engage in unethical behavior.

6. The sixth part of the document discusses the importance of continuing education in the auditing profession. It explains that auditors must stay up-to-date on the latest developments in the field, and must be able to apply this knowledge to their work.

7. The seventh part of the document discusses the importance of teamwork in the auditing process. It explains that auditors must work closely together, and must be able to communicate effectively with each other.

8. The eighth part of the document discusses the importance of risk management in the auditing process. It explains that auditors must be able to identify and assess the risks associated with the audit, and must be able to develop and implement effective risk management strategies.

9. The ninth part of the document discusses the importance of quality control in the auditing process. It explains that auditors must have a strong commitment to quality, and must be able to ensure that all work is done to the highest standards.

10. The tenth part of the document discusses the importance of the public interest in the auditing process. It explains that auditors have a duty to the public, and must be able to act in the best interests of the community.

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1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that this is essential for ensuring transparency and accountability in the organization's operations.

2. The second part outlines the various methods and tools used to collect and analyze data. This includes the use of surveys, interviews, and focus groups to gather qualitative information, as well as the application of statistical software for quantitative analysis.

3. The third part describes the process of identifying and measuring key performance indicators (KPIs). It highlights the need to select metrics that are relevant to the organization's strategic goals and to establish a clear baseline for comparison.

4. The fourth part details the implementation of a data management system. This involves setting up a secure database to store all collected information and ensuring that access is restricted to authorized personnel only.

5. The fifth part discusses the importance of regular reporting and communication of findings. It stresses that management should be kept informed of progress and any emerging trends or issues in a timely manner.

6. The sixth part addresses the challenges often encountered during the data collection and analysis process. These may include issues related to data quality, incomplete responses, and the time and resources required for thorough analysis.

7. The seventh part provides recommendations for improving the overall effectiveness of the data collection and analysis process. This includes suggestions for enhancing the design of data collection instruments and for fostering a culture of data-driven decision-making within the organization.

8. The eighth part concludes the document by summarizing the key points and reiterating the commitment to continuous improvement and data-driven insights.



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- 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
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- 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
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[The text in this section is extremely faint and illegible. It appears to be a list or series of entries, possibly names and addresses, arranged in columns. Some faint words like "No." and "Name" are visible at the beginning of some lines.]

(vii)

No. VI - 3

Claude Grand-Pierre, "Adaptive Research for Grain Production  
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