8. Problems of Irrigation in the Areas of St. Catherine and St. Dorothy (USAID)

今後の調査実施にあたり，参考にすべくレポートとして載せる。

STATE OF ISRAEL

USAID Mission
Jamaica

Canter for International Cooperation
in Agricultural Development,
Ministry of Agriculture

Division for International Cooperation,
Ministry of Foreign Affairs

Ministry of Agriculture, Jamaica
Water Resources Divison

PROBLEMS OF IRRIGATION IN THE AREAS OF ST. CATHRINE AND ST. DOROTHY

Assessment Mission Report

November 1985

PROBLEMS OF IRRIGATION IN THE AREAS OF ST. CATHERINE AND ST. DOROTHY

Contents Page

FOREWORD

This memorandum reports a study carried out by the Israeli Center for International Cooperation in Agricultural Development. The study, which is part of the activities conducted by the USAID, was carried out in Jamaica during the months of July and August 1985 by the following professional team:

Moshe Avidan, economist — team coordinator

Ilan Bar, agronomist

David Salik, engineer

Our grateful thanks are due to the many people who aided the team in its work, and to the institutions with which they are affiliated. Of these, the following deserve special mention:

Mr. T. Hardware, Head of the Water Resources Division

Mr. W. Atiba, Engineer, Water Resources Division

Mr. De-Kruff, Rural Physical Planning Division

Mr. De Will, Rural Physical Planning Division

Mr. S. Rampier, Agro 21

Mr. M. Pennent, Spanish Town Water Commission.

THE ISRAELI CENTER FOR INTERNATIONAL COOPERATION IN AGRICULTURAL DEVELOPMENT

PROBLEMS OF IRRIGATION IN THE REGIONS OF ST. CATHERINE AND ST. DOROTHY

Review of The Existing Situation and Proposals for Improvement

1. INTRODUCTION

1.1. Content and Purpose of the Document

This report presents a summary of the work of a survey carried out to identify problems of irrigation in the area of St Catherine and St Dorothy, Jamaica, according to the terms of reference detailed below, and to propose solutions to these problems. The survey was carried out by the Israeli Center for International Cooperation in Agricultural Development (*ICICAD*), within the framework of the activities of the American institution USAID, the purpose of which is to aid in the development of agriculture in the areas under discussion (hereinafter, the "Project Area").

The work reported in this document is the result of an agreement made between USAID and the Division for International Cooperation of the Israeli Ministry of Foreign Affairs, and was carried out during the months of July and August 1985 in accordance with the terms of reference of the agreement, as detailed in the next paragraph. The team members and their areas of responsibility are given below:

— Moshe Avidan, *economist and team coordinator: economic problems and coordination:*

— Ilan Bar, agronomist: on-farm problems:

— David Salik, engineer: regional water supply problems.

In its continuation, the report contains the following:

(a) presentation of the objectives of the work;

(b) problems of irrigation identified in he area on the basis of the existing and planned agricultural activity;

(c) conclusions and recommendations for improvement.

1.2. Terms of Reference of the Work and its Objectives

The concrete problems which formed the basis of the formulation of the terms of reference of the work are part of a broader range of problems relating to he agricultural development of the Project Area. These problems have been described in a document of USAID as follows:

> "The St Catherine's Plains area is part of a much larger area drained and served by the Rio Cobre, incorporating much of the middle south portion of the island of Jamaica. Not only agriculture but urban concentrations in Kingston and Spanish town make demands on this area's water regime. Demands for water now and in the future present complex problems which should be addressed through comprehensive planning and major infrastructure investments.

The Mission is concerned about the effects of several problems relating to the water regime. Among these problems are the following:

a. Is there enough water for all proposed Project activities?

b. Are there problems of water quality which might affect Project activities?

c. Is siltation from surrounding hillside farms or pollution from agricultural chemicals a problem?

d. Will going forward with the Project lead to a less than optimal overall water development in the area?

e. Are there problems of overlap of utilization or other issues which may arise from the fact that four GOJ agencies currently have jurisdiction over various aspects of water in the proposed Project area?"

It was against this background that the objectives of the team were formulated, as follows (from the USAID and the ICICAD mentioned in paragraph 1.1 above and hereinafter referred to as "The Grantee").

(a) The Grantee will provide services, under the guidance of USAID/Jamaica, to assess the current, institutional arrangements for the management, operation and maintenance of two irrigation systems on the south coast of Jamaica. Included within this assessment shall be a survey of water users (farmers) to determine the level of water availability, water costs, and on-farm water management practices for current cropping patterns.

(b) Following the collection and analysis of information, The Grantee will provide recommendations for an acceptable reorganization of these irrigation systems, that will provide for accountability of management performance and sustainability of the systems based on equitable user fees. The recommendations shall include:

1. A plan and schedule for organizing water user associations for the two irrigation systems. This plan shall provide for the direct participation of representatives of water users in the management of the systems, and, to the extent possible, for the participation of water users in carrying out improvements to and maintenance of the systems.

2. A training plan for the water users in on-farm water management techniques.

(c) Upon acceptance of the plans by the designated Jamaican entities, The Grantee will proceed to implement the plans.

(d) The services to assess and prepare recommendations, as described in paragraphs A and B above, shall be provided by a three-person team (water engineer, agronomist, and economist/sociologist) for six (6) weeks each. The services to implement the plans, as described in paragraph C, above, shall be provided by a three-person team (water engineer, agronomist, and economist/sociologist) for eight (8) weeks each.

(e) In carrying out these services, The Grantee will coordinate with the project coordinator and his staff from the Jamaican Water Resources Authority, and with USAID/Jamaica.

In consultation and coordination with local authorities (paragraph E above) and in view of the current changes in plans for the development and management of the area (inter alia, the Crop Diversification Program decided upon by the government of Jamaica in April 1985, and organizational changes in the local water authorities), special attention was paid to the following subjects:

- water availability
- on-farm water management
- training of the on-farm water consumer.

1.3. Summary of Findings and Recommendations

1.3.1. General

The findings and recommendations relate to the following subjects:

- Improvement of the engineering of the regional water supply system
- Maintenance of the regional system
- Organization of the system's operation
- Water pricing policy
- Irrigation extension service
- Programs of courses in water utilization for farmers and irrigation instructors.

1.3.2. Improvement of the Regional System

The present regional system, which consists of a canal network fed by wells and the Rio Cobre, is not able to supply the current demand of the area (11,500 hectares, mostly sugar cane), particularly in the dry years. The following measures were considered as a remedy to this problem.

(a) The deterioration of the system could be halted by improving maintenance (mainly canal cleaning and well maintenance).

In this case, the two sources of the maintenance budget, water fees and government support, would be enlarged.

(b) Additional water could be provided by the following means:

(1) Extension of the canal system conveyance capacity.

(2) Renewal and addition of wells.

(3) Construction of a seasonal surface reservoir (to store wet season water).

(4) Increase in the use of aquifers for seasonal storage.

The recommendations of the team of the "Water Resources Master Plan" (UNDP project, Interim Report of September 1985) concerning the feasibility of the above alternatives were

adopted, as follows:

a. The "Crop Diversification Program" (CDP) as drawn up by the government for this area will result in a decrease of about 25% in the water demand of the area when fully implemented, because of the difference in demand per unit area of the new and existing crops. This may result in surplus water which will make any new investment in additional water means unnecessary, at least in the short term.

b. It is not feasible to produce new water whose cost is higher than its potential contribution to the national economy. Water that is more costly than the marginal product value of water irrigating sugar cane (some 3 US cents/cubic meter) should not be produced, and insofar as this is possible the water should be transfered from sugar cane to the other, more profitable crops. Because of this constraint only one of the above-mentioned water addition means becomes feasible: extending the canal conveyance capacity to 16 Mcu.m/month, which is one third mre than he existing capacity of 12 Mcu.m/month.

1.3.3. Organization of the System's Operation

The following proposals are made for organizaing the joint St Catherine and St Dorothy system:

1. The system will be operated by a government company (hereinafter,."The Body"), which will be responsible for:

— operating the system according to long-range and short-range programs;
— planning and execution of development programs;
— maintenance of the system;
— demand forecasts and allocation of periodic water quotas;
— water metering and collection of fees;
— financial operation of the system.

2. A general manager appointed by the government will head the system. He will report to the Board of Directors of The Body. The Board will be manned by civil servants (the majority) and consumer representatives.

1.3.4. Water Pricing Policy

The following principles are proposed:

(a) Water prices will relate to volume and not to flow.

(b) The prices will be different for traditional and modern agriculture.

(c) The prices will cover:
   — part of the equipment cost of the water supply system;
   — part of the maintenance costs;
   — the entire power costs, that is, the real cost to he national economy.

(d) That part of the water costs which is not covered by the water fees will be subsidized by the government.

1.3.5. Irrigation Extension Service

Ideally, this much needed service, whose function is to train farmers in the efficient use of water, should be provided throughout the island, but for the time being it is recommended to start it in the Project Area. It is expected that he cost of providing the service will more than covered by the water saved and the resultant improvements in the irrigation system.

The part of the extension service relating to water may be developed before or in parallel with other parts, such as oil and crop protection. It will be operated by instructors, each of whom will have responsibility for a given geographical unit.

1.3.6. Courses in Water Utilization

These courses should be among the first activities provided by the service, and two series are proposed: user and instructor courses.

The user courses will deal with:

- principles of open irrigation, sprinkling and drip irrigation;
- principles of irrigation of different crops.

The instructors' courses will, in addition to the above, deal with:

- soil-water-crop relationships;
- use of control and measurement devices;
- principles of instruction.

2. BACKGROUND

2.1. General

The irrigation systems of St Catherine and St Dorothy form a continuum of abot 12,000 hectares of irrigated land, the Project Area, in St Catherine's Parish, west of the capital, Kingston, in the southern drainage area of the island (see Figure 1). The Rio Cobre river traverses the center of the area on limestone and alluvial aquifers. The Project Area is one of the largest and most important irrigation areas on the island. Its uniqueness and importance arise from its size, its suitability for the growing of new crops (which are expected to partially replace the traditional sugar cane crops), and its proximity to the capital, Kingston, and its suburbs (particularly Spanish Town) which receive their water, inter alia, from sources in the area under discussion.

The area is divided into the following sub-sections:

— The Upper Rio Cobre area: This area has little agriculture, and provides water to the capital from well drillings. Pumping from the drillings in this area is expected to reduce the flow of the Rio Cobre, which supplies the lower area.

— The Lower Rio Cobre area: This is the main agricultural area, with Spanish Town located at its center.

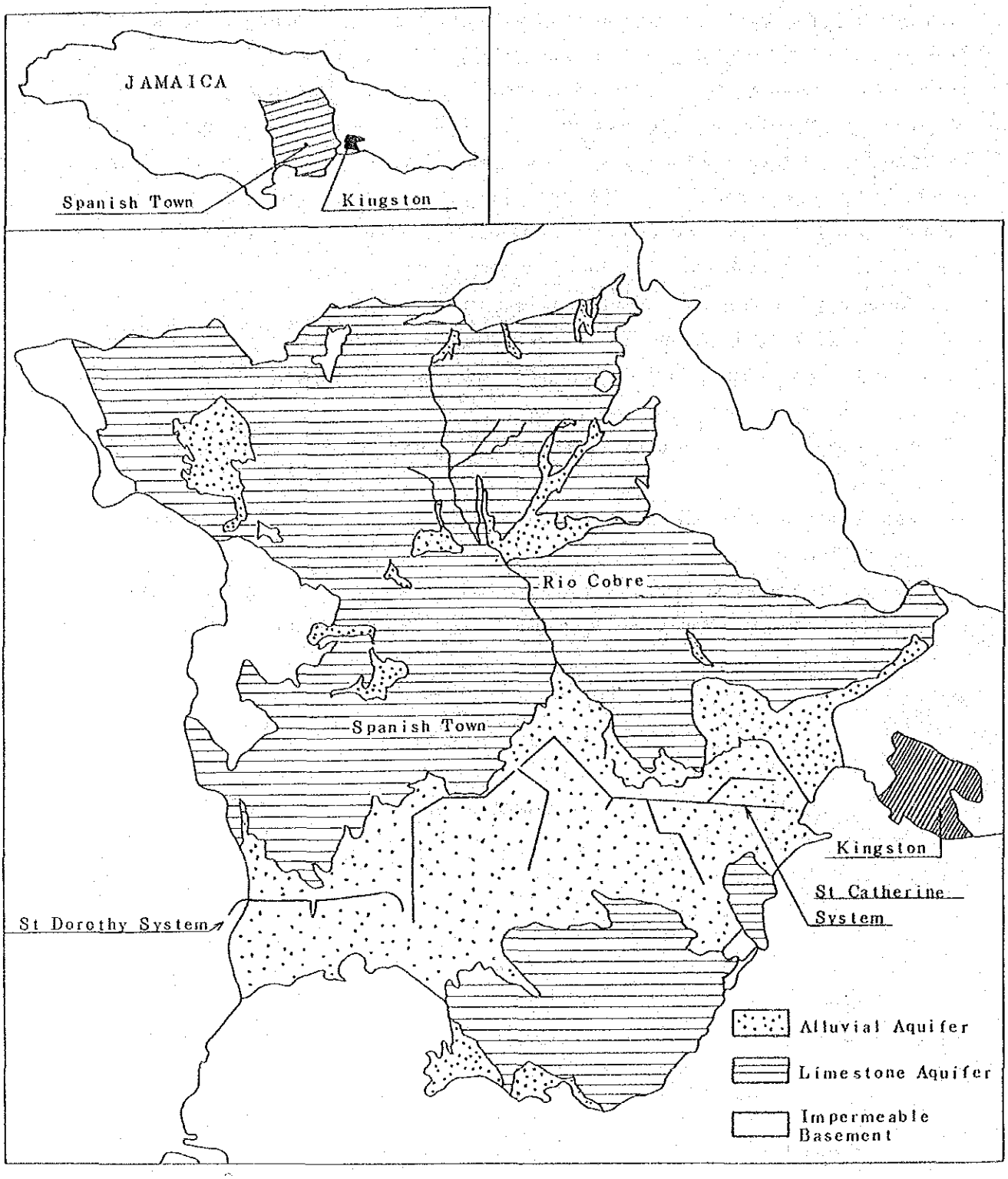
— The St Dorothy area: This area is located in the western part of the region and is fed from well drillings only.

The figures (obtained from the Rural Physical Planning Division) for the rainfall in the center of the region and the rainfall effective for agriculture, in its present form, are given in Table 1 below.

TABLE 1: RAINFALL IN ST CATHERINE

Month	Total Rainfall (mm)	Effective Rainfall
January	21.8	12
February	26.2	14
March	21.8	12
April	36.1	22
May	106.2	70
June	72.6	52
July	40.9	27
August	83.0	50
September	96.5	57
October	207.3	110
November	110.5	65
December	35.6	20
Annual	858.5	511

Figure 1: Rio Cobre Basin — Hydro-Geological Formations and Irrigation Systems



This effective rainfall leaves a demand for irrigation water of some 202 Mcu.m/year in the Project Area, as detailed in the table of Figure 3, below.

2.2. The Agricultural Activity in the Project Area

The following crops are presently grown in the area:

Crop	Area (hectares)
Sugar cane	7,300
Pasture	2,500
Miscellaneous crops	1,700
Total	11,500

Most of the land in the area of St Catherine is owned by state-owned enterprises and that of St Dorothy is mostly privately owned, as detailed below.

TABLE 2: DISTRIBUTION OF THE IRRIGATED AREA BY TYPE OF OWNERSHIP AND SYSTEM (Hectares)

Name of Owner or Type of Ownership	St Catherine	St Dorothy	Total Irrigated Area
Inswood	2,340		2,340
Bernard Lodge	5,600		5,600
Caymanas	1,400		1,400
Private west of Inswood	300		300
Others — private	260	1,600	1,860
Total	9,900	1,600	11,500

The low profitability of sugar cane has led the government to formulate a policy to replace this crop by others (The Diversification Program). The crops under consideration are mainly winter vegetables for export, sorghum, corn and soya.

2.3. Institutional and Organizational Data

The main bodies representing water users are state-owned enterprises which own the sugar cane plantations (see Table 2). The water systems in the area -- with the exception of private drillings -- are owned and operated by the government (the Ministry of Agriculture).

The main body actively engaged in agricultural development in the area is the state-owned enterprise "Agro 21", which is described briefly below.

- It is subordinate to the Prime Minister's Office
- Representatives of the Ministry of Agriculture, the Treasury, the Ministry of Planning, the Ministry for Foreign Affairs and other public institutions form part of its management.
- Its central purpose is to establish projects for growing field crops, vegetables nd other produce, in order to promote the following objectives:
  * growing produce for export
  * growing produce for the domestic market and for import replacement
  * increasing employment

In this context, and in accordance with government policy, the trend is towards decreasing to a minimum the sugar cane area and utilizing the water and land thereby made available for growing the market and industrial crops mentioned above. The planning activities are being carried out, inter alia, by the following organizations:

- The Water Resources Division, which is presently in the process of becoming the Ground Water Authority
- Agro 21
- USAID
- UNDP, which is presently preparing a plan for the area under discussion, within the framework of a master plan for the water resources of the whole island.

Though there is much planning activity underway, no unit exists whose task it is to deal with the subject of irrigation at the on-farm level. A similar situation prevails in the university, at the experimental stations and in the government training system.

2.4. The Water Systems

The water supply systems included in the framework under discussion are those of St Catherine and St Dorothy. Following is a description of these systems and details of their operation and maintenance.

2.4.1. The St Catherine Water Supply System

The sources of water supplied by the system for irrigation are:

- the Rio Cobre river
- the limestone aquifer
- the alluvial aquifer

Following is a description of the supply of this water within the framework of the system.

The Rio Cobre water is diverted to the main canal (see Figures 1 and 2) in which the manimum water level is +139 feet. Most' of the irrigated land is located between the levels of +50 and +100 feet, so that irrigation is possible mostly by gravitation, without pumping. The main canal was designed for a conveyance capacity of 23 Mcu.m/month, but its present capacity is only some 12 Mcu.m/month, due to deterioration of the system. Several manually-operated gates located in the vicinity of the diversion structure enable control of the diversion. The gate system is in poor condition, and it is difficult to control the diversion efficiently. Another problem is that the system is blocked up with water vegetation and siltation. More serious still is the problem of the weir which was constructed in the main canal to divert water to the urban water supply of Spanish Town. This weir caused a considerable decrease in the canal's conveyance capacity. Near Spanish Town the main canal splits into two branches, to the east and to the west (see Figure 2).

The system is composed entirely of earth canals, with a total length of 75 km. The maintenance condition of the canals is poor. The sides of the canals are badly damaged, causing water losses, and this is further aggravated by farmers breaking up the walls to divert water. The water is supplied 24 hours a day without any measuring devices, so that distribution is done by very rough estimation. This means that some users are deprived and others are oversupplied, resulting in considerable waste. Furthermore, users, in partisan fashion, construct lateral weirs in the canal to boost he supply of water to their fields. This too contributes to the decrease in the system's conveyance capacity.

2.4.2. Ground Water System

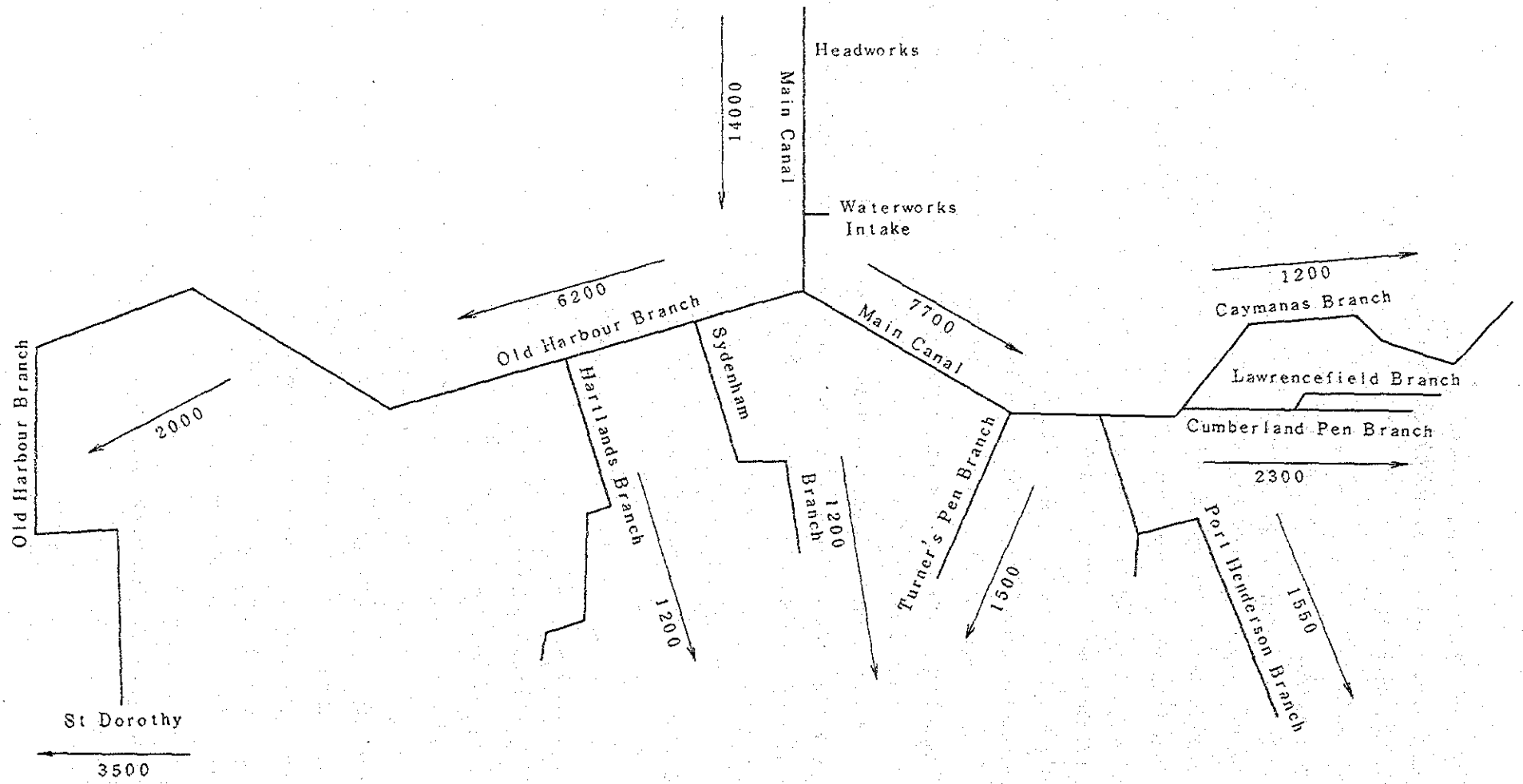
(a) The Limestone Aquifer

About 70 wells have been drilled to pump water from the limestone aquifer. Part of them are out of use due to blockage and deterioration of equipment. The wells were drilled to depths of between 30 and 100 meters and their discharge is between several tens to several hundreds of cubic meters per hour. The wells are generally not equipped with water meters. Water levels are not routinely monitored and their maintenance is poor. Some of the wells supply water to urban and industrial users. There is no up-to-date and comprehensive map of the well network and its connections to the canal system and the users.

(b) The Alluvial Aquifer

There are about 45 alluvial wells in more or less the same condition of deteroriation as the limestone wells.

Figure 2: Lower Rio Cobre Canal System



Figures indicade existing flow capacity in m^3/hour

TABLE 3: MAIN AND BRANCH CANALS OF THE SYSTEM

Name of Canal	Length (km)	Area Served (hectares)	Existing Conveyance Capacity (cu.m/h)
Main A	4.7	9,433	11,500
Main B	4.7	5,610	7,700
Turner's Pen	3.4	610	1,550
Port Henderson	4.8	2,075	1,550
Caymanas	5.1	1,395	1,200
Cumberland	3.2	1,530	2,300
Old Harbour	5.6	3,730	6,200
Sydenham	3.9	820	1,200
Hartlands	3.5	560	1,200
Old Harbour sub-branch	6.9	2,350	2,000

2.5. Water Supply and Consumption at the On-farm Level

2.5.1. Availabilityand Reliability of Supply of Water

From inspection of the area and conversations with the people involved, the following picture emerges.

Water supply to the farms is uncertain and erratic, so that, at St Dorothy, whenever water is available the farmers use it all to irrigate their fields, whether they need to or not, sometimes even continuously for two or three days. Sometimes they even break down the exit gates of the main canal to increase the flow of water to their fields. Needless to say, this is wasteful and even harmful. Fertile soil is washed away, crops are damaged because of lack of ventilation, and there is an increase in the incidence of soil and leaf diseases. At the same time, there are periods (such as the time we spent in Jamaica) during which for three weeks there is not a drop of water in the canals and no rainfall, and sensitive produce, such as cucumbers, squash and melons, simply collapses.

In such a situation of catch as catch can, measuring and control of water lose all meaning, and the only thing that can be done to improve management of irrigation is, during times of water surplus, to store it in the soil. In the clay loam of Bushy Park, for instance, it is possible to store up to 200 cu.m of water to a depth of 1.2 meters, and this can be useful for certain crops.

2.5.2. Methods of Irrigation and Current Practices

(a) Open Irrigation at St Dorothy

The following is typical of the Project Area. At Bushy Park, there is furrow irrigation of cucumbers, water melons, hoosydew melons and onions. A typical furrow is about 250 meters long and the distance between furrows is about one meter. Total irrigation time is about 20 hours and it takes about eight hours for the flow to reach the perimeter of the area. The soil is black-brown, defined as clay-loam, tending more to loam. There are no infiltration problems and the gradient is very falt (according to the map it is about to be 1%).

Sample drillings made four days after irrigation showed the soil to be saturated almost to field content, to a depth of 1.2 meters. The manager of the farm, who had complained about the lack of water, was surprised to see, from this drilling, how he was wasting water in depth on his water melons andonions, whose main root systems reach a depth of only 30 cm.

(b) Open Irrigation at St Catherine

Most of the irrigation in the area of St Catherine is concentrated on the sugar cane, which is grown in 10-acre square fields, each field being divided into two irrigation units. The soil is silt clay to clay for the most part. The length of the furrow (typically 200 meters) is quite adequate for the gentle gradient and the soil quality. Irrigation is carried out once every three weeks, by breaking through the side wall of the distribution canal and allowing the water to flow into the

furrows, which are spaced about 0.9 meters apart. As soon as the water reaches the perimeter of the irrigation unit, the flow is shut off and transferred to another unit. Irrigation time per unit is about six hours. The requirements for sugar cane during July, the peak month, are about 200 Mcu.m. Under conditions of 35% irrigation efficiency and an effective root depth of 90 cm, the required irrigation level is not supplied when needed (not taking rainfall into account). It is little wonder, therefore, that the average yield is between 20 and 30 tons per acre, that is, about half the yield possible under conditions of proper irrigation.

(c) Sprinkling

A number of farms have introduced sprinkler irrigation. Farmers have been attracted to this method of irrigation for various reasons, some because it is considered fashionable and modern, and some because of its convenience, especially for dry sowing irrigation. Furthermore, some believe that the low discharge of the open irrigation system in any given period of time does not enable complete coverage of the cultivated area, while sprinkling does.

In practice, as in open irrigation there is no control over the quantities of water used or the depth of wetting, attained or desirable. Some farmers irrigate very superficially, stopping as soon as they feel the soil is wet to the depth of a handspan, and move the line to the next section. On the other hand, there are those who start irrigation again as soon as the surface layer is dry, even though in many cases the lower layers are saturated. In brief, there is much wastage of water.

As for the equipment itself, the sprinklers are not uniform. The uprights are neither uniform nor straight, and the spacing between sprinklers is not uniform. The water is not filtered before entering the lines and the sprinklers often become blocked. The farmers solve this problem by removing the heads and this, of course, produces a short, heavy jet. The discharge rises, the pressure goes down and the uniformity of distribution is adversely affected. The sprinklers stop turning and the result is flooding in one area and dryness of another. This, naturally, leads to non-uniformity of the cultivated area and a reduction in yield. The lines are not washed out before operation, and this gives rise to another source of blocking. Furthermore, the line ends in a sprinkler and not in a blind pipe — yet another common cause of blocking.

2.5.3. Water Metering and Pricing

Under the existing pricing practices, each consumer has a discharge contract (designated in cu. yd./hour) limiting his maximum hourly discharge, which, when multiplied by 8,700 hours per year, gives his maximum permitted annual discharge. Since he has to pay for the water whether he uses it or not, the user, naturally, tends to use the water whether he needs it or not. This system of payment based on flow rather than volume is, therefore, a disincentive to saving water.

The following pricing, as practiced in the St Dorothy system, is typical:

Cost of 1 cu. yd./hour	J$50
Price of 1 cu. yd./hour	J$12

In the case of continuous flow, this means:

Price of 1 cu. yd. = 12/8700	= Jc1.38
Price of 1 cu. m	= Jc1.8
Cost of 1 cu. yd. = 50/8700	= Jc0.57
Cost of 1 cu. m. =	= Jc0.75

The difference between he cost and the price is subsidized by the government.

3. IRRIGATION PROBLEMS

3.1. General

The region's irrigation problems center around the background data presented in the previous section and the following economic data.

(a) In the area under discussion there is today not enough water to irrigate the arable land available. Water is therefore the scarce input for the agricultural activity. At the same time, the use of such water as is available is wasteful and inefficient, at both the system and on-farm levels.

(b) The urgent improvement int he existing situation that is so badly needed is hampered by the too-low product value of water in the country's agriculture, based as it is on sugar cane, which is no longer a profitable crop. The following calculation illustrates this point. The marginal product value of water used in irrigating sugar cane is some USc3/cu.m. (as reported in the Water Resources Master Plan conducted by the UNDP and the Water Resources Division). This value is too small for it to be worthwhile to make large-scale investments in improving the water system; the extra water obtained thereby will generally cost more than USc3/cu. m. (see table in section 4.1.3).

(c) The water systems used in irrigating sugar cane are in very poor condition and, from the point of view of the national economy, it is not worth investing in repairing, renewing and maintaining them, to continue cultivating this unprofitable crop. Only by switching to more profitable produce, that is, effecting the government's Crop Diversification Program, will the investment be worthwhile. However, this program, if it is carried out on a large scale, casts doubt on the worthwhileness of increasing the water supply, because the diversification cros will require much less water than sugar cane and their introduction will release quantities of water for other uses. It will be possible to use this surplus water to increase the arable land area, thus rendering the provision of new water unnecessary (see Figure 5).

(d) The Crop Diversification Program is likely to obviate the need for producing new water, but not the need to derive more benefit from the existing water. The activities of an extension service cannot be covered by the low value generated by sugar cane and pasture; they could, however, be covered by the relatively high potential value of the new crops, when this branch of the economy matures.

3.2. Problems of the Central System

The following areas of activity of the central system require urgent attention:

- maintenance
- operation (control of the quantities of water supplied and measurement)
- expansion

Each of these areas has an economic-engineering aspect and an organizational aspect.

(a) The cheapest water in the system is the gravitational water required (cleaning of canals and routine maintenance of wells) costs less than this, it is certainly justified economically.

The operation of the central system needs improving. Supplying consumers according to thier needs with water from the canals, and in accordance with a ready made program, is a central aspect of the operating system. This can be done properly only with a well-run system of controlling devices (and this is the easier part of the problem), water measuring devices, and pricing.

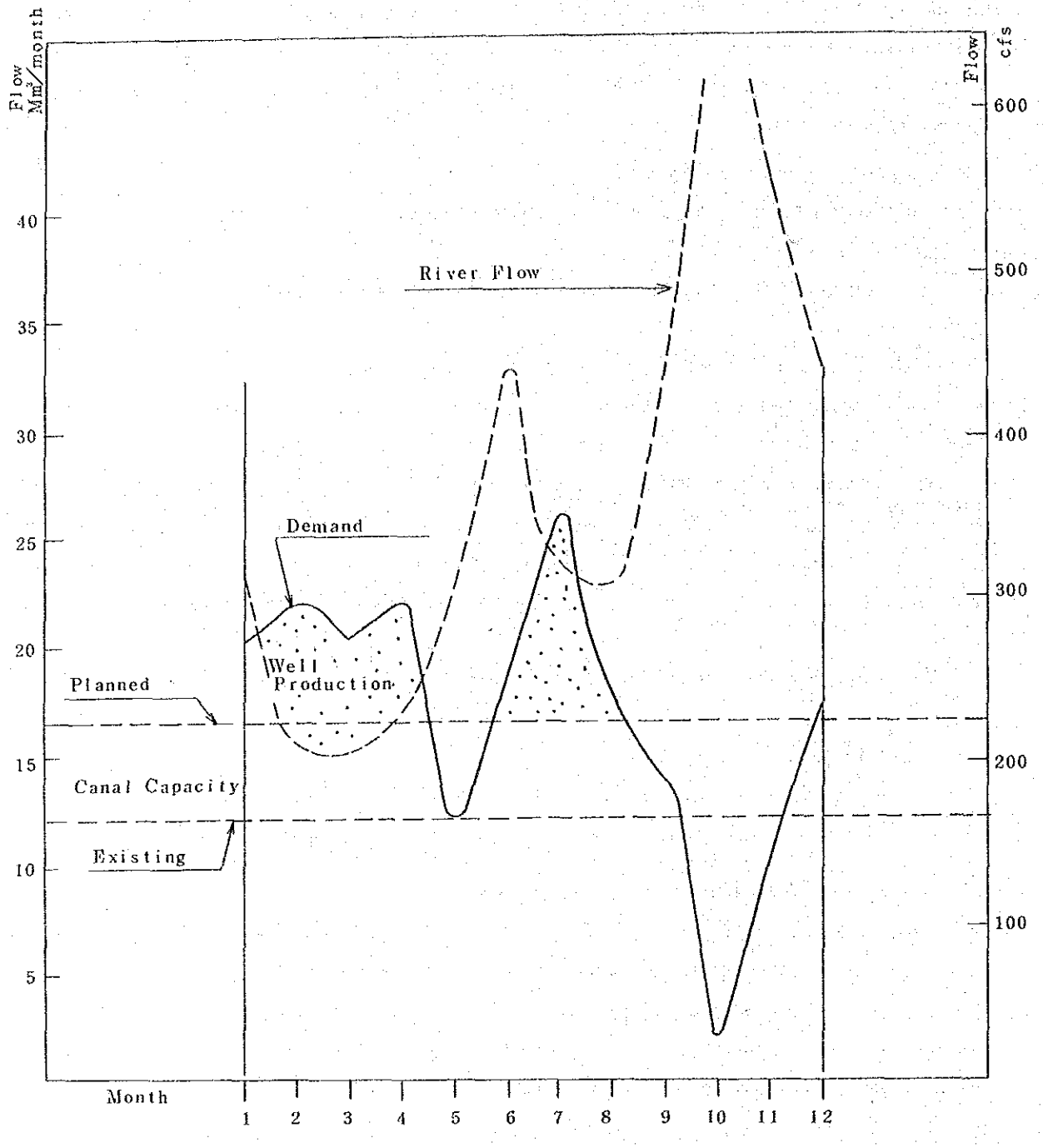
The questions which arise in connection with the problem of improving the pricing system are:

- Sould the price be based on the cost of the water or part of it?
- Should the traditional consumer, the sugar cane farmer for the most part, be subject to he same pricing and allocation mechanism as a consumer cultivating new produce?

3.3. Problems of Water Usage at the On-farm Level

There are the problems of inefficient irrigation and unreliable water supply. The latter problem must be solved within the context of the central system, while the former depends upon the activities of the extension service, which will provide the missing knowhow to the farmers. As for the extension service itself, problems of its scope, organizational structure, financing (should the farmers be expected to pay for the service or not) and training of personnel are still to be solved.

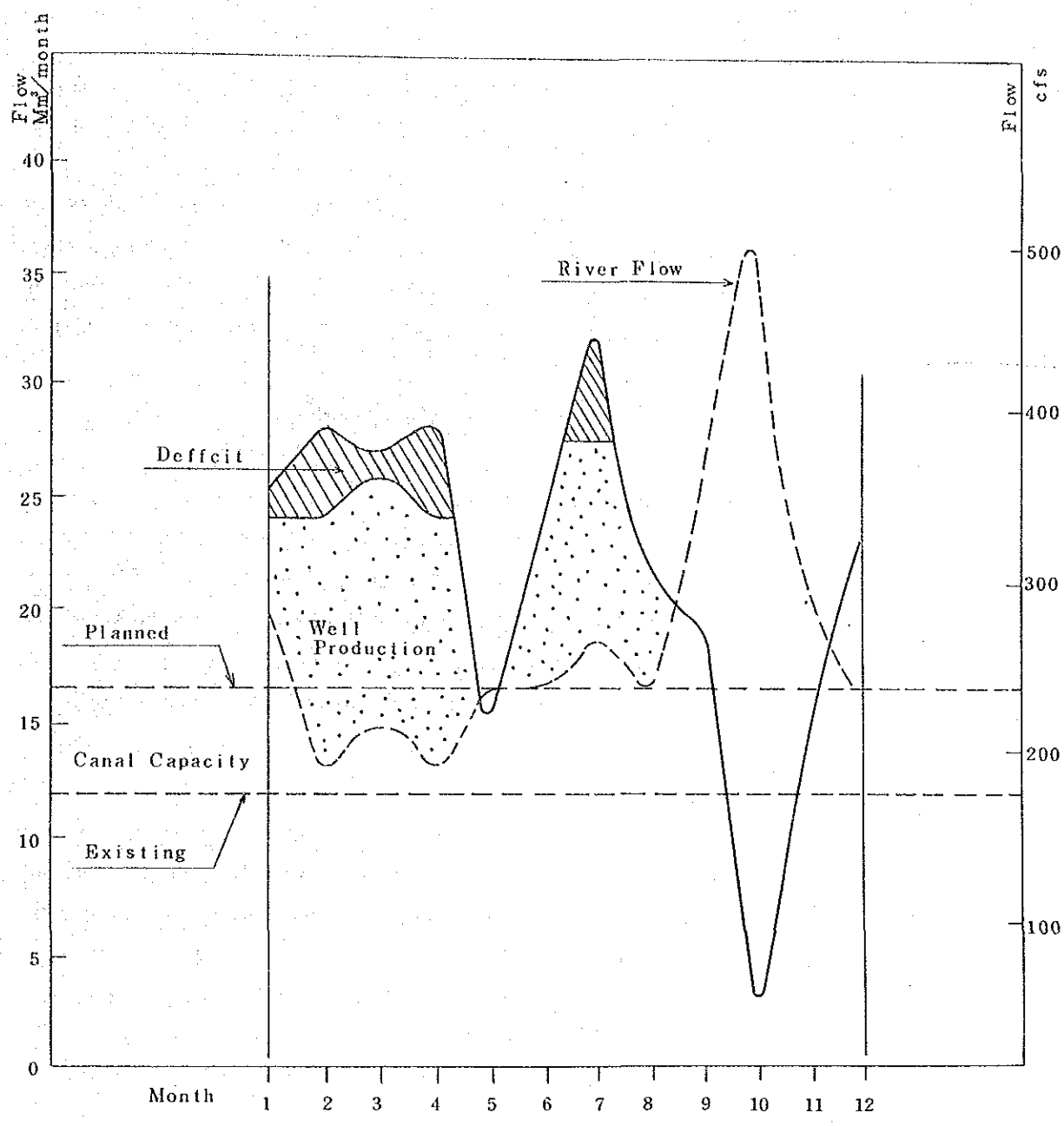
Figure 3: St Catherine Project -- Irrigation Water Demand and River Flow (Mean Year)



Month		1	2	3	4	5	6	7	8	9	10	11	12	Total
Demand Mm³/month*		20.0	22.0	20.0	22.0	12.0	18.0	26.0	17.0	14.0	2.0	11.0	18.0	202.0
Water Supply for irrigation	Total	20.0	22.0	20.0	22.0	12.0	18.0	26.0	17.0	14.0	2.0	11.0	18.0	202.0
	Canal	16.5	15.0	15.0	16.5	12.0	16.5	16.5	16.4	14.0	2.0	11.0	16.5	168.0
	Wells	3.5	7.0	5.0	5.5	–	1.5	9.5	0.5	–	–	–	1.5	34.0

* Includes losses in canal system – 20%

Figure 4: St Catherine Project — Irrigation Water Demand and River Flow (1:5 Dry Year)



Month		1	2	3	4	5	6	7	8	9	10	11	12	Total
Demand Mm³/month*		25.0	28.0	27.0	28.0	15.0	23.0	32.0	22.0	19.0	3.0	14.0	22.0	259.0
Water	Total	25.0	24.0	26.0	24.0	15.0	23.0	27.5	22.0	19.0	3.0	14.0	23.0	245.5
Supply	Canal	13.5	13.0	15.0	13.0	15.0	16.5	16.5	16.5	16.5	3.0	14.0	16.5	172.0
for irrigation	Wells	8.5	11.0	11.0	11.0	–	6.5	11.0	5.5	2.5	–	–	6.5	72.5

* Includes losses in canal system – 20%

4. PROPOSALS FOR IMPROVEMENT

4.1. The Central System

4.1.1. General

The following proposals are made for the Rio Cobre area.

(a) Improving the system in accordance with the plans detailed below, taking into account the following:

(1) Implementation of the Crop Diversification Program will defer the need to produce additional (new) water, since it will make use of water presently be used for sugar cane.

(2) Improvements in the various parts of the system are constrained by the necessity to keep the new water cost below the marginal product value of the water, estimated at USc3/cu.m.

(b) Reorganization of the entire system with lines as described below.

(c) Establishment of an allocation and payment policy for the water supplied.

4.1.2. *Coordination of the Development with the Crop Diversification Program*

Since about half of the Rio Cobre area is designated for the Crop Diversification Program, it may be expected that about one quarter of the present water discharge of the system will be made available for other uses. The new crops will use about 1,000 Mcu.m/year while sugar cane takes 2,200 Mcu.m/year. This dictates delaying any new water development, especially water whose cost is greater than the income from sugar cane, as shown in Figure 5 and detailed in section 4.1.3. below.

4.1.3. Viable and Non-Viable Development

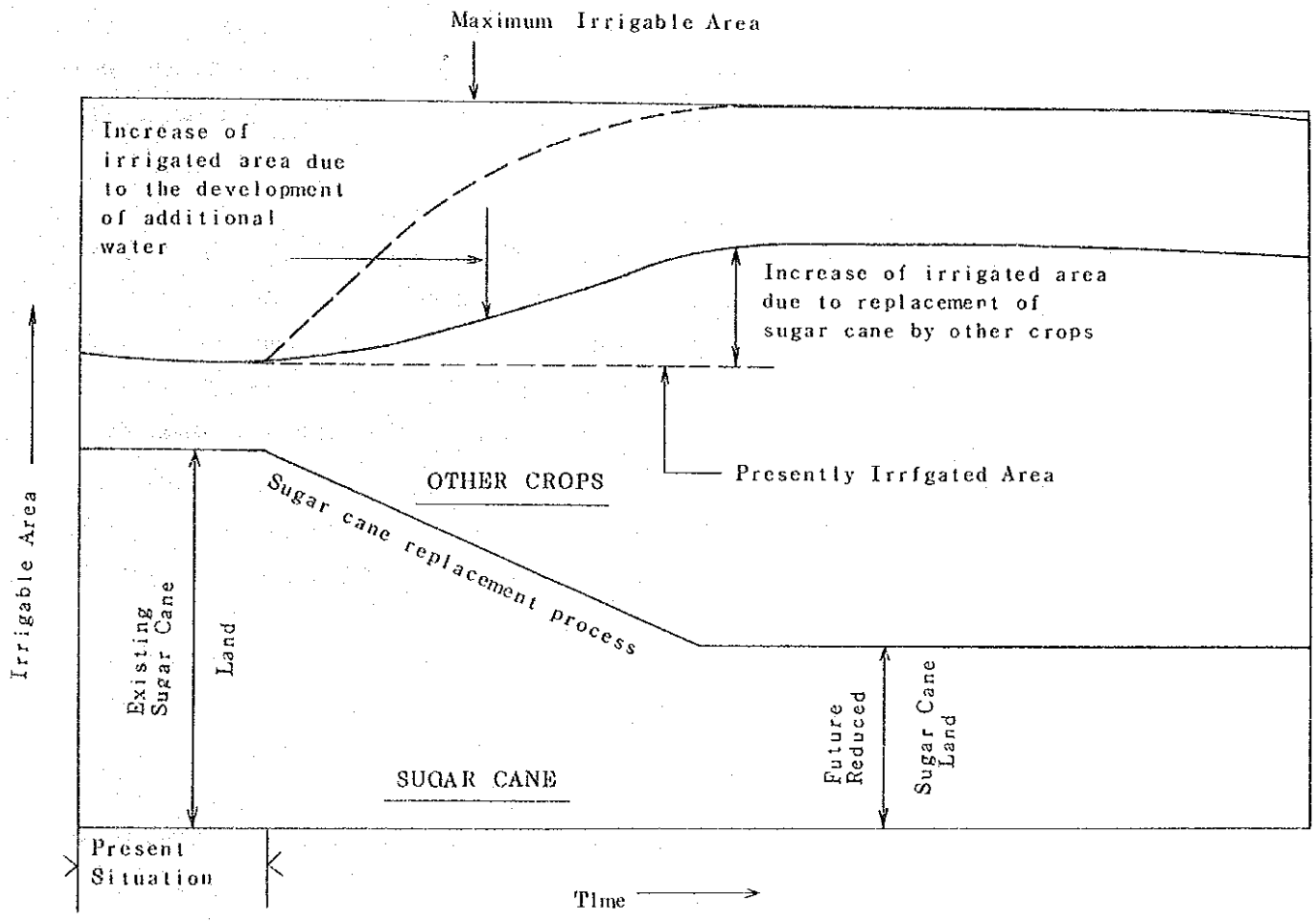
As stated above, it is not proposed to develop water whose cost is greater than its economic contribution, which is, as stated, the marginal product value in irrigating sugar cane (USc3/cu.m). The cost of developing new water is being investigated or is about to be investigated by a number of bodies, some of which are listed below:

- A Japanese team which is to engage in planning means of increasing the supply of the Lower Rio Cobre.
- A team from the UNDP and the Ground Water Authority, which is working on the Water Resources Master Plan.

The latter team recently developed a simulation model of the area, but their findings have not yet been made available. When they do become available, we shall make use of them, and in the meantime we have been using their preliminary findings on the costs of additional water supply by various alternative means, summarized below.

Means of Increasing Supply	Cost of Water (USc/cu.m)
Expansion of canal capacity from 10 Mcu.m/month to 16 Mcu.m/month	1.4
Expansion of canal capacity from 16 Mcu.m/month to 20 Mcu.m/month	18.2
Surface reservoir (10 Mcu.m)	36.6
New well	6.3

Figure 5: Possible Changes of Irrigated Area With Time — Factors Affecting Irrigated Area Extent — Schematic Representation



From an Interim Report of the UNDP Project of the Water Resources Master Plan, April 1985

Taking the narginal product value of water for irrigating sugar cane to be some USc3/cu.m, these data lead to the conclusion that expanding the canal capacity to 16 Mcu.m/month is the only one of the proposed means that is entirely worthwhile.

The general development policy suggested is:

(a) As a first stage, the canal should be restored to proper working order and converted to a capacity of 16 Mcu.m/month, and the existing wells should be repaired.

(b) Any further plans should be delayed until the Crop Diversification Program reaches the point where the water requirements of the new areas are no longer met by the surplus water generated by replacement of sugar cane by crops that consume less water.

4.1.4. Management of the System

Following is a proposal for managing the joint regional water supply system of St Dorothy and St Catherine. The proposal is expensive, and the existing agriculture will have difficulty in financing and justifying it economically. Full implementation of the proposal will therefore be feasible only when the Crop Diversification Program is carried out.

The system will be operated by a body which may be a public corporation or have a different status (hereinafter "The Body"). The Body will manage the water supply as a closed, non-profit making system with two sources of income — payments for water supplied and a government subsidy. The Body will be subordinate to a Board of Directors. Following are details of the structure of The Body and its functions.

(b) Functions of the Body

(1) The Body will operate the system according to short and long-term plans. These plans will be prepared by The Body and authorized by the Board of Directors.

(2) The Body will collect orders for water from the users and evaluate the water availability, to provide a basic for operating plans.

(3) The Body will establish water quotas for users, which will be valid after authorization by the Board of Directors.

(4) The Body will measure the water used and collect payment therefor.

(5) The Body will draw up development palns, which will be valid after authorization by the Board of Directors.

(6) The Body will execute development plans.

(7) The Body will manage the financial aspects of the system.

(c) Manpower

The positions to be manned are as follows:

1. A General Manager, to be appointed by the government and report ot the Board of Directors.
2. A professional staff comprising an engineer, agronomist, economist, hydrologist and computer man.
3. Foremen experienced in maintaining water supply systems.

4. Unskilled laborers.

5. Office staff.

6. Outside help as required.

Total staff requirements are estimated at 40—60.

(d) Main Machines Needed for Operation and Maintenance

(1) One bagger with effective boom of 20 meters

(2) Two baggers with effective boom of 10 meters

(3) Three small baggers

(4) Three shuffles on wheels D6

(5) One bulldozer on chains D6

(6) One motor grader

(7) Ten cars with front wheel drive and means of communication.

(8) Four heavy vehicles

(9) Six private cars with means of communication

(10) Radio station for communication

(11) Computer

(12) Maintenance materials

(e) Main Buildings

(1) Office block

(2) Shed for machines

(3) Stores for materials

(4) Gasoline station

(f) The Board of Directors

The Board of Directors will initially be staffed by civil servants, one of whom will be appointed General Manager of The Body. The Board will be responsible for the following tasks.

(1) supervising the water supply procedures

(2) nominating members of The Body's management

(3) deciding on investments, to he extent that this is requested by the government

4) determining water pricing policies, to the extent permitted by the government

(5) determining future plans of The Body

(6) ensuring efficient running of the system.

At a later stage the Board will co-opt consumer representatives as members. These will be farmers from St Catherine and St Dorothy, and at this stage the two systems will be united into one project. The composition of the Board will then be 51% civil servants and 49% consumer representatives.

g) Structure of The Body

The Body will comprise six divisions, as follows:

(1) A division responsible for water resources.

(2) A division responsible for water allocation and demand assessment.

(3) A division responsible for the distribution of water and its measurement, and the amount of water to be supplied to the farmer in each head plot. This division will have overall responsibility for the operation of the entire system.

(4) A maintenance division.

(5) A division responsible for all economic and financial aspects of the operation, including billing the farmers.

(6) An administrative division responsible for computer, bookkeeping, clerical and house maintenance services.

4.1.5. Payment Policy

The basis for the proposed payment policy is payment according to measured volume (and not according to flow). This policy will also apply to water supplied by open conduits. It is recommended to install a water meter in each head plot, so that the farmer will know exactly how much water he is receiving.

In the first stage, payment will continue to be made as it is today by flow. In the second stage, the farmers will start paying for the water by measured volume actually used, after they are assured that they are getting their water in the quantities and at the times they requested. As to rates of payment, it is suggested that the following principles be applied:

- Distinction should be made between traditional users and new users who enter the system with implementation of the Crop Diversification Program. The new volume rates will apply immediately to new users, and will be applied gradually to the traditional users.
- The price of the water will comprise three elements:
  - coverage of the investment
  - energy cost
  - maintenance costs

  Each of these elements wil be subsidized or taxed by the government, as follows.
- Coverage of the investment will be only for the mechanical equipment (not for civil engineering structures) and there will be a number of levels of subsidy according to the status of the user (traditional or new).
- The entire energy cost will be imposed upon the user (at its cost to the national economy). This will be done in order to prevent uneconomic and exaggerated use of this resource (if it is subsidized) or too limited use (if it carries a tax).

— The maintenance costs will be divided between the user and the government.

4.2. Improvements at the On-farm Level

4.2.1. General

As shown in sections 2 and 3, there is much room for improvement in the use of water at the on-farm level. It is also clear from the facts presented in these sections that trained on-site instructors could very easily, with the means available, at little cost and often with just a few simple words of advice, do much to increase the efficiency of the existing issigation procedures by tens of percentage points and save vast quantities of water. All this could be done before investing a single penny in renovating the central water system.

Improvements could be made mainly by the following means:

— explaining to farmers about existing and desirable procedures in the context of plant-soil-water relastions;
— adapting irrigation methods to the nature of the area and the water;
— training farmers in the use of efficient irrigation methods;
— adapting crop rotation procedures to the availability of water in the different months of the year.

The present peak demand month is July. By introducing new crops with different peak demand months (such as soy bean — June, maize — April, cotton — December, and vegetables — December), the total July peak could be lowered.

Some of these activities could be conducted within the organizational framework of the extension service. In the next paragraphs, the technical aspects of the areas to be improved will be described (as background material for the activities of the extension service) and a presentation will be given of:

— a proposal for the organizational structure of the extension service;
— programs of courses to be offered within the framework of the extension service.

4.2.2. The Various Irrigation Methods and Their Adaptation to Regional Conditions

(a) Open Irrigation

A good and inexpensive way to achieve high efficiency in open irrigation is to construct a system of repeated water usage, that is, use of the tail water from one field to begin irrigating the next lower field. In this way, the water flows for long enough to enable even distribution throughout the field. The silty clay soil of the region, the gentle gradients and the fact that large tracts of land are in the hands of single owners, contribute to making this an ideal method of irrigation. The width of a typical irrigation unit is about 100 meters and the length of the furrow is 200 meters or more. The lowest field can have a zero gradient. This method is particularly well suited for growing rice.

Since the lateral gradient is often also very low, it is possible to transfer water to the adjacent field in a direction perpendicular to the direction of irrigation, as soon as there is a build-up of water in the canal. Water can also be supplied to the distribution canals at the heads of the plots by the supply canal.

Another way of attaining high levels of efficient of irrigation and distribution (close to 100%) is by "level-basin irrigation". This method can be applied with both furrows and flooding. The ground is leveled to zero gradient and walled in. Water enters the area at maximum flow, but such that is does not cause erosion. Water distribution by this technique is excellent and not a drop is wasted. The water can be allocated in a precise quantity and confined to the field where it is required. The medium and heavy soil types of the area seem to be well suited to this technique. Furthermore, most of the land in the area is almost flat, so that the work of leveling will be minimal. A condition for the success of this method is, of course, accurate leveling to zero gradient. Today, this can be done easily with laser levelers. It is important also to remember that the effective rain percentage in the case of level-basin irrigation is much higher than with any other method of irrigation: it can reach a level of over 90%, as compared with 50—80% for other methods.

(b) Sprinkling

Sprinkling is suitable for those areas in which the gradients are steep, the topography presents difficulties and the investment required for leveling is prohibitively high, or when leveling is impossible, or the soil is sandy.

Limitations of the sprinkler method are: a high initial cost, the high incidence of breakdowns, the routine maintenance requirements for spare parts, energy consumption, the necessity to filter the water, and the increase in the incidence of leaf diseases.

Another relevant factor in this area is the wind regime. Sprinkling is usually done during the 16 hours between afternoon and morning. The wind velocity during the remaining hours is usually higher than the 2.5 m/sec desirable for sprinkling.

Other points specific to the subject of sprinkling in the area of St Catherine are detailed below.

(1) In a number of soils, such as Sydenham clay, there are problems of crust formation after the first watering, rapid closing of cracks and a sharp fall in the rate of infiltration (estimated at about 3—5 mm/hour — final rate). In such a case, sprinkling will cause run off. Since the areas have irregular gradients, there will be considerable losses of water because of the run off. In these cases, of course, the preferable alternative is open irrigation, in which the gradients and drainage are controlled, and in the case under discussion level-basin irrigation is again to be preferred, since exploitation of rain water from the point of view of run off is maximal.

(2) To the extent that it is intended to turn forest areas into agricultural land, and to the extent that it is intended to irrigate with sprinklers, it would be desirable to leave strips of natural wind breaks between the plots. These natural wind breaks will perhaps reduce the intensity of the winds in the field and enable efficient sprinkler irrigation. The wind breaks should

be placed perpendicular to the most frequent wind direction (south-east to west). The width of the plots will be determined by the height of the wind breaks.

(c) Drip Irrigation

Drip irrigation is suitable for all soil types and all kinds of topography. It may be used to advantage in very light soils (sand dunes) and in very heavy, non-draining soils. The cost of this method is very high and operators of the system must be trained in its use. Another point, specific to the conditions prevailing in the area, is the need for careful filtering. The source of the water is the Rio Cobre or wells whose water pours into the open canals (apart from a few isolated cases in which pipes are used to transport the water to the head plots). The main kinds of dirt in the water are weeds and floating organic matter. These are the hardest to deal with and require very expensive filtering systems, which should preferably be equipped for automatic flushing. Drip irrigation systems in the project area will therefore be particularly expensive. Admittedly, the saving in work days is considerable, but this is not always an advantage.

It is possible that in the area of St Dorothy, where most of the water supply comes from wells, it will be possible to install a drip system in small plots and for capital-intensive vegetable growing. Since the number of wells is large in relation to the area as a whole, in comparison with the other project areas, it is possible to lay out a pipe network to the heads of plots that would not be too expensive. This closed water system would decrease the necessity for an expensive filtration system, since most of the dirt would be sand and solid floating matter for which the required filtering systems are less expensive. The fact that the farmers in the area grow vegetables in a number of rotations each year will constitute a suitable economic base for drip irrigation, especially if we also take into account the increase in yields and their quality that results from the use of drip irrigation on the one hand, and the decrease in pesticide costs, on the other.

4.2.3. Organization of the Extension Service

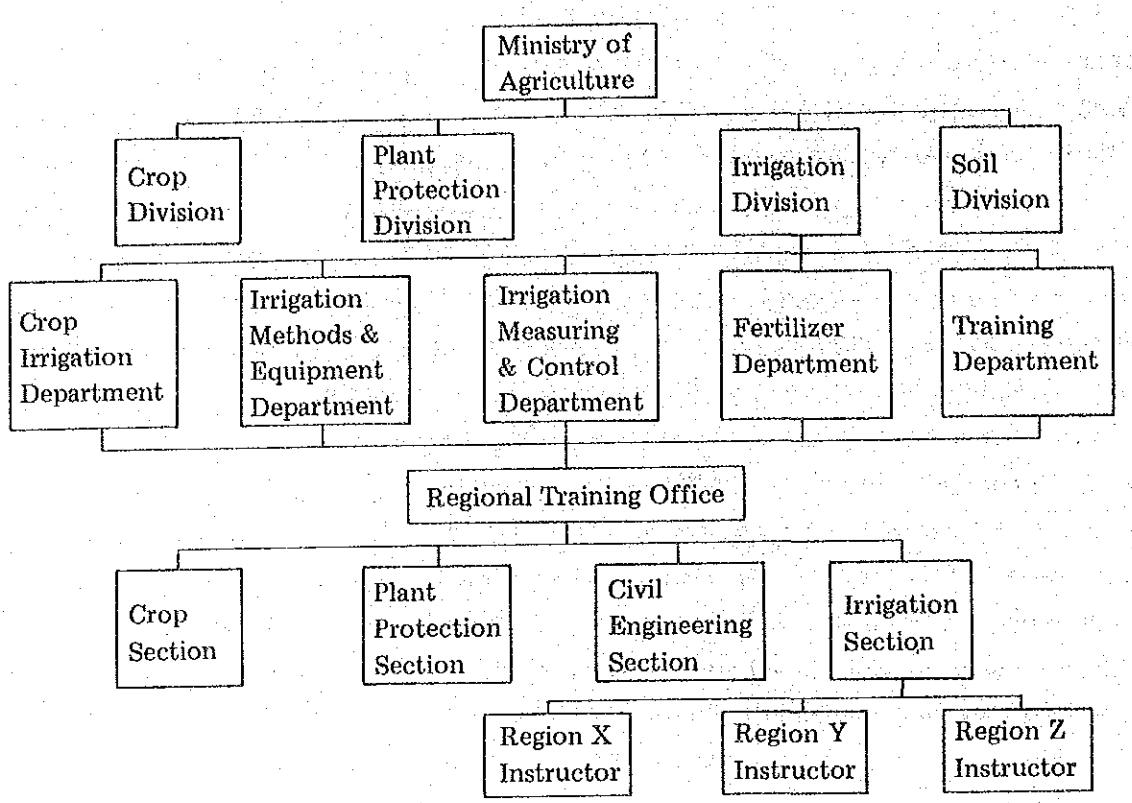
Various ways of organizing training systems such as the extension service have been tried through out the world, and methods of training suitable for different conditions have been developed. It seems to us that the conditions prevailing in Jamaica, particularly in the Project Area, in terms of the manpower to be trained and the variety of irrigation methods and crops to be grown, dictate the following organiztion proposal.

As will be shown below, training in irrigation methods is only part of the much broader system of agricultural training (though there is no reason not to introduce training in irrigation separately) and it is built on a professional hierarchy (subordinate to the Irrigation Department of the Ministry of Agriculture) and a geographical hierarchy (of division into sub-regions affiliated to the regional training office).

Establishing an extension service has, of course, a national significance beyond the limits of the Project Area. At the same time, it must be remembered that the Project Area is particularly suited to begin such a service.

The proposed organizational structure of the service is given below.

STRUCTURE OF THE EXTENSION SERVICE



4.2.4. Samples of Extension Service Course Programs

One of the main activities of the service is provision of courses. The programs of two typical courses are given below, one for farmers and one for instructors.

(1) Course for Farmers

The major part of the course material should be devoted to the following subjects:

(a) Principles of Open Irrigation

1) Methods of open irrigation
2) Gradients
3) Flow size
4) Length of furrow
5) Effect of soil type and gradient on the above-mentioned parameters
6) Calculating the quantity of water
7) Calculating irrigation time
8) Techniques for managing the water and organizing the field by various methods

(b) Principles of Sprinkler Irrigation

1) Types of sprinklers
2) Pressure and discharge capacity
3) Positioning and maintenance technology
4) Locating problems and solving them
5) Calculating the quantity of water and irrigation time
6) Spread
7) Suitability of soil and crop to the above parameters

(c) Principles of Drip Irrigation

1) Types of drip systems
2) Filtering
3) Incorporating fertilization into the irrigation process
4) Calculating the quantity of water
5) Locating problems and solving them
6) Layout of the network and

(d) Crop Irrigation

The water economy of existing crops (vegetables, fruit, field crops)

(e) Principles of Fertilization

1) The importance of fertilization and its benefits
2) Types of fertilizers and their function
3) Methods of applying fertilizers

The course will be based for the most part upon on-site demonstrations of all the irrigation and fertilizing techniques, part of the time being devoted to the farmers practicing what they have learned in the course. Special attention will be paid to control of irrigation (before, during and after).

(2) Course for Instructors

This course, in addition to providing practical knowhow, as in the farmers' course, will include theoretical principles which will enable the instructors to make correct decisions in the field, on the basis of the variable data, and further their education and level of expertise. One of the purposes of the course will also be to enable the instructors to carry out field experiments and observations and to analyze them and draw the correct conclusions, on the one hand, and to train them to apply the results of their research at the on-farm level, on the other. In addition, therefore, to the material contained in the farmers basic course, the following subjects will be studied.

(a) Soil-Water-Plant Relations

1) Mechanical composition of soils
2) Chemical composition of soils
3) Physical properties of soils in the context of irrigation, such as: field capacity, wilting point, level of available soil water, permeability.
4) Chemical properties in the context of water requirements and plant nutrition, such as: salinity, chalk content, fertility (N.P.K. and micro elements), boron, chloride, sodium, magnesium and calcium ions, E.S.P.
5) Quality of water and its effects on soil properties xxxxx plant development (Ec, S.A.R.).
6) Estimating the water consumption of the plant, facto?? affecting it, and the reciprocity between consumption, quality of water and soil type, in conjunction with ecological data.

(b) Use of Irrigation Control and Measuring Devices

1) Hand drill
2) Gravimetric testing of wetness
3) Tensiometers
4) Pan evaporation
5) Lysimeter
6) Plant parameters (potential pressure and others)

(c) Testing of Spread and Efficiency of Irrigation — for the three methods of irrigation: open, sprinkler and drip.

(d) Determining Size of Plots, Pressure and Discharge Rate — for the three methods of irrigation:

1) Open — determining the channel length, advance and retreat curve, infiltration capacity, initial and final flow, calculation of irrigation time and quantity.

2) Sprinkler — calculating the optimal number of sprinklers per line, calculating pressure and discharge losses, placing of sprinklers, sprinkling rates, and principles of planning.

3) Drip — calculating branch length, pressure and discharge rates, types of drip, placing, spread, laying out and rolling up, routine maintenance, and principles of filtering.

(e) Principles of Fertilization

1) Fertilizer types and their behavior in different soil types and under different irrigation regimes.

2) Methods of applying fertilizers, taking into account the fertilizer-soil-irrigation method reciprocal relations, climate and plant.

3) Combining fertilization with irrigation:

a) by-pass flow technique — installations and method

b) direct flow technique — installations and method

4) Calculating quantity of fertilizer for:

a) fertilizing by quantity or per area

b) proportional fertilization

(f) Principles of Sampling in the Field

1) Sampling to determine wetness, volume weight

2) Sampling to determine fertility (N.P.K.)

3) Sampling to classify and adapt soil type

(g) Use of Laboratory Testing

1) Reading results of laboratory tests

2) Providing recommendations, calculating water and fertilizer quantities on the basis of laboratory tests

(h) Use of Demonstration Techniques

1) Cardboard classifier

2) Felt board

3) Transparencies and overhead projector

4) Sampling and cross-sections

(i) The Human Factor in Teaching

1) Planning a lesson

2) Principles of teaching and dialogue

3) Working in groups

4) Communication and teacher-student relations

(j) Salt Content and Quality of Water

There are in the Project Area lands which have been rendered useless by their high salt content. These will be studied.

9. セント・ドロシー地区の概要は次の通りである。

B R I E F

INTRODUCTION

The St. Dorothy Plain Irrigation Authority was established by the St. Dorothy Plain Irrigation (Establishment) Order, 1961. The Authority is run by a Board, which is appointed by the Minister.

The day to day workings of the Authority is handled by a Staff of 37 persons, headed by a Works Oversees.

The main Functions of the Authority are namely:-

1. To manage, control and operate, subject to any directions given by the Minister, the Irrigation System in the relevant Irrigation Area.

2. To manage and control the distribution of water from the System.

3. To formulate and implement programme for development of the Irrigation Scheme.

The National Water Commission is to give the necessary technical advice and assistance to the Authorities to enable them to function efficiently.

The area over which the Authority has jurisdiction is approximately 20,000 acres. However, a large portion of this area is to hilly and rugged for irrigation and consequently, irrigation at present is confined to the Plains. The area which is capable of being economically irrigated is about 5,500 acres. The total acreage under cultivation which is served by the System is approximately 4,614 acres. The Crops cultivated are mainly Sugar Cane, Banana, Citrus and Catch-crops, i.e. (Peppers and Vegetables) also Fish Pond. Jamaica Soya Products and other Dairy and Cattle-rearing enterprises are also supported by this Irrigation System.

THE IRRIGATION SYSTEM

This System consists of 7 Deep Well Pumps, supplying approximately 4,340 Cubic Yars per hour (0.93 m^3/s), per annum to 210 contracted farmers. The Pumps are located as follows.

NUMBER	LOCATION
2	Free Town) Clarendon
1	Sandy Bay)
2	Bodles
1	Bowers
1	Kilbys
7	

BREAKDOWN

TYPE OF SYSTEM	OUTPUT FROM WELLS	CONTRACTED SUPPLY	NO. OF CONSUMERS	ACREAGE UNDER CULTIVATION
FLOOD	3,394	3,205	108	4,197 1/2
SPRINKLER	946	409	102	416 1/2
TOTAL =	4,340	3,614	210	4,614

SIZE OF SCHEME

TYPE OF SYSTEM	LOCATION	DISTANCE FROM OFFICE	LENGTH OF SYSTEM
FLOOD	Woodstave	1 Mile	1 3/4 Miles
FLOOD	Lined Canal	1/2 Mile	16 3/4 Miles
SPRINKLER	Sandy Bay	6 Miles	5 Miles
SPRINKLER	Bowers	2 Miles	2 Miles
SPRINKLER	Kilbys	5 Miles	1 1/2 Miles

The Woodstave Pipeline constructed well over 29 (Twenty-nine) years ago, carries most of the water in the System. The Authority also has a few miles of open canals.

There are 3 (Three) Wells in this System, which employ the more economical Overhead Sprinkler System. These Wells are at Bowers Pen, Kilbys and Sandy Bay.

Recently an extension to thel andy Bay Scheme was handed over to the Authority by the National Water Commission. This extension is designed to irrigate an additional 150 acres. This extension is now in operation but farmers in this area, lack the necessary farm equipment.

STAFF LIST

1. 1 WORKS OVERSEER I TSS GT IV
2. 1 WORKS OVERSEER II TSS GT II (VACANT)
3. 1 ACCOUNTANT FAA II
4. 1 CLERICAL OFFICER CR II
5. 1 TYPIST OPS I
6. 2 PUMP ATTENDANTS LMO II
7. 1 FIELD ASSISTANT LMO IV
8. 1 OPER, MECHANICAL UNIT LMO II
9. 1 SNR. CANAL ATTENDANT LMO III (VACANT)
10. 5 CANAL ATTENDANTS LMO II
11. 1 CANAL DISTRICT CONSTABLE CS SSG I
12. 1 WATCHMAN GLS I
13. 1 OFFICE ATTENDANT GLS I
14. 5 WEEKLY PAID LABOURERS LMO I (1 VACANT)

DAILY PAID LABOURER 1
TEMPORARY WATCHMAN 4
TASK WORKERS 6
PART-TIME OFFICE CLEANER 1
TEMPORARY PUMP ATTENDANTS 2

The Authority is faced with many problems at this time, they are as follows:-

1. Extreme shortage of water due to saline intrusion and drought.
2. Large amounts of arrears owing to Jamaica Public Service Company which results in the frequent disconnection of Pumps.
3. Low Revenue because of low Irrigation Dues.
4. The delapidated, vandalized and leaking Woodstave Pipeline.
5. Shortage of Vehicles.
6. The delapidated buildings and furnishings.
7. The wastage of the little water available because of defective on-farm equipment, defective Canals and Syphons.
8. Lack of relevant training for the Staff.
9. Rapid cut in expenditure (MINISTRY)
10. Blocking of Canal at nights and on weekends.
11. Shortage of Staff.
12. Outstanding Water Dues by Consumers.
13. Recording devices for Pumps.

ST. DOROTHY PLAIN IRRIGATION AUTHORITY TYPES OF CROPS AND ACREAGE

TYPE OF SYSTEM	CONTRACTED SUPPLY	NO. OF CONSUMERS	ACREAGE UNDER CULTIVATION		TYPES OF CROPS AND ACREAGE						
					GRASS	CANE	CATCH CROP	BANANA	POUL	FISH	FACT.
FLOOD	3,205	108	4,197 1/4	ACREAGE	1,530	2,253	292	61	14	4 1/2	-
				CUB. YARD	1,150	1,793	192	21	6	47	53
SPRINKLER	409	102	416 1/2	ACREAGE	67 1/2	17	314	1	17	-	-
				CUB. YARD	62	17	314	1	17	-	-

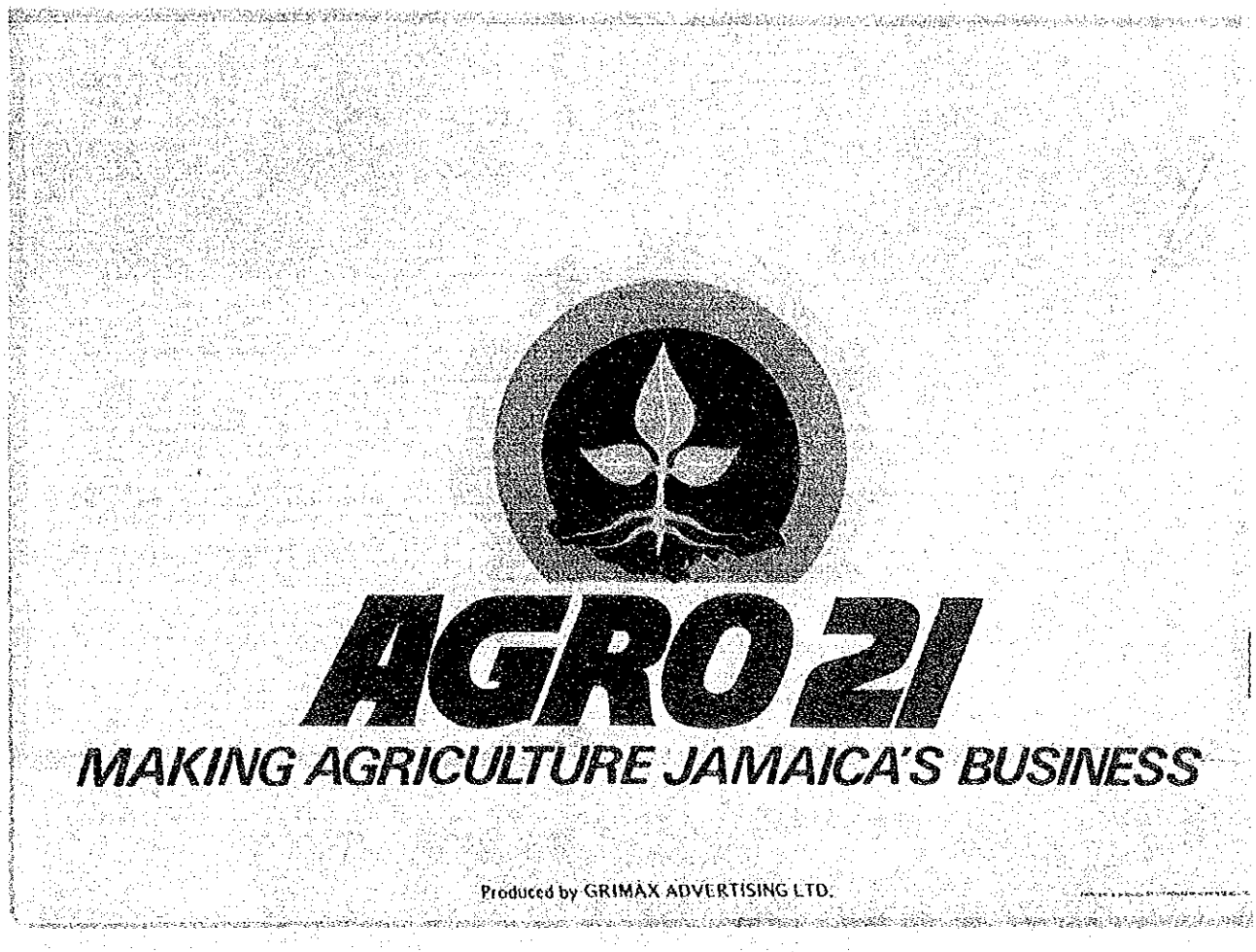
PERFORMING OF WELLS: ST. DOROTHY PLAIN IRRIGATION AUTHORITY

NAMES OF WELLS	H. P.	DEPTH	CASING I.O.	DISCHARGE CAPACITY		RATING OF POWER	DATE OF MEASUREMENT	Date of Drilling
				U.S.G.P.M.	CYDS YDS PER HOUR			
Free Own # 1	150	100"-0"	24" O.D.	4,968	1,475	128.5 K.W. Per/hr.	4th January, 1982	1956
Free Town # 2	125	100'-0"	24" O.D.	3,822	1,135	91.3 K.W. Per/hr.	4th January, 1982	1956
Marine Terminal	50	120'-0"	15" O.D.	1,135	337	27.6 K.W. Per/hr.	9th September,1981	
Bodles	50	175'-0"	16" O.D.	1,504	446	33.4 K.W. Per/hr.	9th September,1981	
Bandy Bay	150		24" O.D.	2,300	683	121.6 K.W. Per/hr.	10th September,1981	197—
Bowers	60	154'-0"	16" O.D.	550	163	48.5 K.W. Per/hr.	10th September,1981	
Kilbys	20	150'-0"	12"	343	101	12 K.W. Per/hr.		
Kilbys(Booster)	20	-	-	-	-	12 K.W. Per/hr.		

MILEAGE OF MAIN CANAL AND DISTRIBUTARIES

MAIN CANAL					
Woodstave Pipe	9,200 L.F.	Approx.	1 3/4 Miles)	Total	
Concrete Flute	1,188 L.F.	"	1/4 Mile)		
Lined Canal	35,838 L.F.	"	6 3/4	8 3/4	Miles
	DISTRIBUTARY A				
Lined Canal	13,908 L.F.	Approx.	2 3/4 Miles)		
18" c.c. Pipeline	1,443 L.F.	"	1/4 Mile)	3	Miles
	DIST. A2				
Lined Canal	5,137 L.F.	"		1	Mile
	DIST A3				
Lined Canal	1,980 L.F.			3/8	Mile
	DIST B				
Lined Canal	2,037 L.F.	"		3/8	Mile
	DIST C				
Lined Canal	1,237 L.F.	:		1 1/4	Mile
	DIST.E				
A/C Pipeline	2,600 L.F.	"		1 1/2	Mile
	4,554 L.F.	"			
	DIST F				
Lined Canal	5,280 L.F.	"		1	Mile
	DIST F1				
Lined Canal	759 L.F.	"		1/7	Mile
	DIST F2				
Lined Canal	3,696 L.F.	"		3/4	Mile
	DIST G				
Lined Canal	2,739 L.F.	"		1/2	Mile
	DIST H				
Earthen Canal	1,584 L.F.	"		3/10	Mile

１０．ＡＧＲＯ２１パンフレット



STATEMENT FROM THE PRIME MINISTER & MINISTER OF FINANCE & PLANNING

The Rt. Hon. Edward P. G. Seaga

AGRO 21 was conceived as a new thrust in Agriculture emphasising a number of new features:

(1) As this document will show, in the first instance Agro 21 involves putting a possible 200,000 acres of land into commercial production over the first 4 years. Its first purpose is to put idle land to use for the betterment of the country.

(2) It involves commercial level production which refers not only to the size of undertaking but to the level of technology. It is the first time that a concentrated effort is being made to attract and combine the most advanced technology available with sizeable capital and land. I emphasize COMMERCIAL PRODUCTION as distinct from previous agricultural plans which relied on Government involvement.

(3) A whole range of new crops are featured in this project, breaking away from the traditional approach of concentrating on a few well-known crops. If agricultural production is to increase dramatically it must mean both additional crops and additional markets. This project satisfies both.

(4) New markets which direct exports to North America and Europe, as well as substitute for traditional imports, are a principal objective of this programme. The crops identified in the first 200,000 acres all have good market prospects to the production levels indicated.

No matter what developments take place in manufacturing and construction, the two main employment generating productive sectors, neither of these sectors can provide the amount of employment needed, particularly in the rural areas, nor the extent of foreign exchange earnings on a net basis.

Only agriculture, of the productive sectors, can provide high net foreign exchange earnings, and high labour employment, at a low per capita cost.

Agro 21 has the potential of dramatic expansion for the agricultural sector, an injection of capital and technology into the resource-starved rural areas of Jamaica. It proposes a fundamentally different approach to agriculture which with success can revitalise the agricultural sector to the dominant position it once occupied, and provide for the rural people new levels of opportunity.

It is called Agro 21 because if it uses well these new opportunities, no better commemoration of the 21st Anniversary of the Independence of Jamaica can be offered to our people than a programme to blaze a new trail both in,

and on, the LAND WE LOVE.

Edward Seaga
Prime Minister
& Minister of Finance & Planning

STATEMENT FROM THE MINISTER OF AGRICULTURE

The Honourable Dr. Percival Broderick

The Agricultural Sector has always been projected as one of the main planks in this administration's strategy for economic recovery and development. In order to accomplish this, a great deal of preparatory planning had to be done to identify the resources of land, investment, technology and markets and to bring these together.

This has now been done and is reflected in the dynamic programme "Agro 21" which seeks to mobilize the sector and tap its true potential to meet our foreign exchange needs through earnings and savings and to provide meaningful employment for our people.

Perhaps one of the most significant accomplishments of this programme is the concentration, certainly in the initial stages, upon the development of lands which have been idle or under-utilised. The programme will provide excellent opportunities for farmers who already own lands but do not as yet have a structured arrangement for its development. This provides an ideal basis for profitable joint ventures. It also provides opportunity for the land-less who will share in new opportunities on idle land. It must be noted also that the programme addresses the development of agro-industry to provide outlets and thus strengthen demand for the farmers' products.

Agro 21 should be supported by the farming community since the transfer of technology through the involvement of the land authorities in the various regions will benefit many farmers – large and small.

This administration seeks to modernize our agriculture within the framework of a comprehensive rural development programme and "Agro 21" is but one initiative towards this end and therefore, merits full support.

Percival Broderick
Minister of Agriculture – Hope

Why AGRO 21

The economic strength of our nation must be based on a proper balance of emphasis between the important sectors of our economy. Jamaica's emphasis over the past 21 years has mainly been on industry, mining and to an extent on tourism, with far less emphasis on agriculture. Unless Jamaica's exports and hard currency earning capacity is large enough to pay for what we must import, the economic strength of our nation will continue to be eroded.

Most of our export crops have had serious and heavy declines since 1970, in such staggering proportions that they have dramatically weakened our economic base. Banana exports fell from 134,000 tons in 1970 to 27,000 tons in 1982. Sugar fell from 293,000 tons in 1970 to 134,000 tons in 1982. Similarly, citrus, cocoa, pimento, ginger, have all declined in export quantities, further reducing our foreign exchange earning capacity. During that time, thousands of acres of Jamaican land became idle, adding to the already large areas of land which are either not in use, or under-utilised. The country now urgently needs to catch-up with the years of neglect in agriculture. It must now re-vitalise agriculture as rapidly as possible to reverse these trends and to find new ways of earning more out of export agricultural efforts. That's why a concentration of national efforts is needed to gain rapid growth in agriculture on a scientific and business-like basis. That concentration of national efforts has now been put into place as one of the major policies of Government through the launch of Agro 21, to put our unused and under-used land to work as a major earner of foreign exchange. What is even more significant is that agriculture is the largest employment sector and one of the quickest ways of creating jobs for our people.

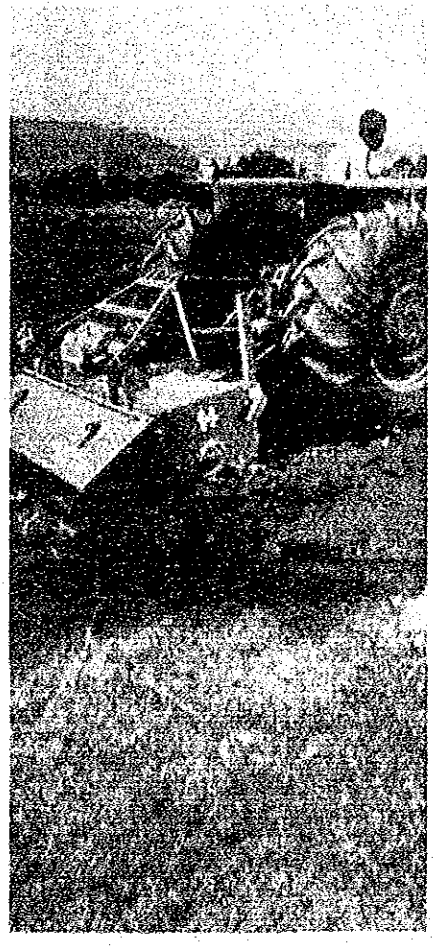
We are launching Agro 21, therefore, to –

Put our land to work
Put our people to work; and
To earn more foreign exchange.

AGRO 21 IS...

Agro 21 is a new national approach to agriculture that combines the implementation of modern technology with proper planning and targeted markets to deal with agriculture on a business-like basis. It is not a bank, it's not a market place, it's not a tax incentive programme, but a vehicle to address six vital areas in the Agricultural Sector.

1. To use to capacity the unused and under-utilised land of the country.
2. To increase our Export Agriculture in a range of specific crops.
3. To introduce new employment opportunities in agriculture.
4. To integrate the small farmers into the new opportunities in Agro 21 project areas and to make modern technology available to them so as to help them to improve their production.
5. To develop non-traditional crops on a wider basis by increasing production of existing crops and by introducing new crops.
6. To increase import substitution wherever possible so as to reduce dependence on imports for crops we can grow.



REVERSING THE DECLINE IN AGRICULTURAL EXPORT

Because of the lack of emphasis over the years on the production of agricultural products for export, Jamaica has been faced with a situation in which it has not been able to supply its available guaranteed markets or to take advantage of new opportunities as they present themselves. Agro 21 will give priority treatment to the reversal of these trends and to increase our production on a steady, programmed basis.

1. BANANAS
   Under Agro 21 the programmed expansion of banana cultivation is aimed at fulfilling Jamaica's U.K. market quota of 150,000 metric tons per year. Over a period of 4 years, a total of 12,000 acres of new varieties will be planted. By year 4, this project alone will satisfy approximately 60% of the quota or 98,000 tons.
2. COFFEE
   Demand for Jamaica's Blue Mountain Coffee far exceeds production. To take advantage of this opportunity for earning foreign exchange, Agro 21, working with the Coffee Indsutry Board have identified 10,000 acres of land for expansion of production. Financing is already in place for the development of 6,000 acres of this. Lowland Coffee production is being expanded by 3,000 acres with the help of funding through the EEC to further boost foreign exchange earnings from this product.
3. CITRUS
   This product is aimed at increasing the export of fresh fruits, fruit juice, fruit preserves, canned fruit, concentrates and oils. Of the 6,000 acres planned for expansion, specific sites for 5,500 acres have been selected in St. Catherine, St. Elizabeth, Clarendon and Manchester to fulfill 92% of the planned programme. The development will be undertaken by the Citrus Growers Association under the loan financing provided by the International Bank for Reconstruction and Development, the European Development Fund and the Government of Jamaica.
4. COCONUTS
   Coconuts will be re-established as a dependable source of edible oils and fats. Production had declined by 30% between 1979 and 1982, and during that period imports rose by 85% in crude and refined coconut oil imports. Under Agro 21's programme of expansion, 500,000 trees will be planted each year over a 7-year period, utilising 35,000 acres of land. Of this, 10,164 acres have already been replanted. The project is being implemented by the Coconut Industry Board and is aimed at fully satisfying the national demand.
5. COCOA
   Jamaican cocoa, including cocoa powder, cocoa butter fat or oil, cocoa confectionery, plus shells, husks and waste account for approximately $12-million in exports, yet this volume represents only 1% of world demand.
   Through a rehabilitation programme managed by the Cocoa Industry Board, 5,000 acres of small farmer holdings will be brought back into full production to boost output by approximately 46% over 4 years.

DEVELOPMENT OF OTHER NON-TRADITIONAL CROPS.

Aside from the present range of agricultural crops which we produce there are great opportunities available to Jamaica because of our proximity to main U.S. and Canadian markets, and special trading arrangements with Europe for a range of exports not now in production. Agro 21, using modern technology will develop a wide range of these new crops for existing markets.

Winter Vegetables

Comprising a mix of green peppers, honey dew melons, tomatoes, cucumbers, sweet peppers, sweet corn, okra and snap beans, winter vegetables will be produced for export to U.S. and Canadian markets during the winter months when their domestic production is reduced. The U.S. market for this range of production was estimated at U.S. $3,000 million in 1982 and select market strategies will target on gaining market shares in the U.S., Canada and the E.E.C. to an equivalent of 10% of the U.S. market.

A total of 6,398 acres out of a planned 8,000 acres have been identified. Firm investments have been concluded for 1,515 acres whilst negotiations are going on for another 4,883 acres. The majority of investors in this area have links with vegetable markets in North America and Europe.

Horticulture

In 1982 Jamaica exported ornamental horticulture totalling $3 million to 15 countries. Agro 21 is aiming at bringing into cultivation 1,000 acres more of flowers and 700 acres of foliage by 1986 to increase Jamaica's share of existing markets and earn approximately $29 million by 1986. Development of nursery and cultivation acres have begun. Specific sites suitable for these crops have been identified in Clarendon, St. Mary, St. Catherine, St. James, St. Thomas and St. Andrew.

Orchard Crops (Mango, Avocado, Guava, Lychee, Ackee & Papaya),

This project is aimed at expanding Jamaica's export markets to the U.K., Canada, U.S.A., Australia, Switzerland, New Zealand, Bermuda and the Netherlands for fresh, canned and preserve products. So far investments in 40 acres of these crops in Clarendon have been committed. Preliminary discussions are also being held for the development of 4,760 acres in 6 parishes.

Fish / Shrimp

This project is aimed at launching the commercial production of shrimp and fish for export to inland states of the U.S. and Canada initially. The strategy is to use marginal productive agricultural lands to create nursery and brooding ponds for shrimp and fish and provide other facilities for processing, packing and freezing. Emphasis will be on perfecting production techniques in order to create a base for the general development of an Aqua-culture sub-sector in Jamaica and to substitute for a portion of our imports of approximately 4,800 tons of fish and 73 tons of shrimp which in 1982 together cost us $7.5 million.
Already 674 acres are in production in St. Elizabeth, Clarendon, Trelawny, Westmoreland, St. Thomas and St. Catherine.

NEW AGRICULTURAL OPPORTUNITIES

A number of new crops and expansion of existing opportunities will take place in rural Jamaica thereby laying the foundation for the development of Agro industrial opportunities on a wide scale.

Aloe Vera

This project is geared to cultivating Aloe Vera (known in Jamaica as "Single-bible") in commercial quantities to provide Aloe extract for export to the North American market. This product is in great demand in the world for use in the medicinal and cosmetic industries. As a spin-off of the cultivation of this product, factories are programmed to be established for the manufacture of Aloe Vera gel and eventually the production of Aloe extract.

This crop is labour intensive throughout the year and can be grown on marginal land to provide continuous income to farmers. The crop yields a high income and is suitable for small farmer cultivation.

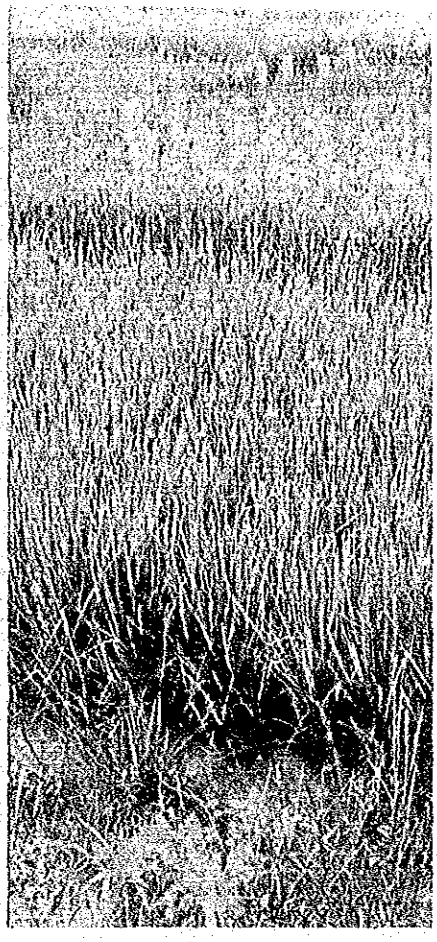
So far, 1,000 acres have been identified on a 1-acre to a farmer basis. Five nurseries totalling 75 acres are now being planted and construction of an Aloe Vera gel factory is scheduled to start in February, 1984, at Hague, near Falmouth in Trelawny.

Beef

The strategy for the development of beef production embraces small, medium and large farms. New technology to upgrade stock will be introduced, using embryo transplants and artificial insemination to carry out an intensive breeding programme using local heifers. By year 5 of the Agro 21 period production will have reached the level for imports in 1982 which stood at about 3 million lbs. Negotiations have been finalised for investment on 2,526 acres in 3 parishes while preliminary discussions are being held for private investment covering 23,000 acres in two parishes.
The spin-offs of increased beef production will lead to the development of the leather, bone meal, resin and tallow industries.

Bee-Keeping

Young people will form the initial thrust in rejuvenating bee-keeping in Jamaica. Firm commitments have been made in this direction by several youth organizations under the guidance of the Ministry of Youth and Community Development, and 1,065 hives have already been assigned to this aspect of the project. Jamaica's exports in 1982 totalled 8,000 gallons. The projection is for a production of 48,700 gallons in 5 years and 506,500 gallons valued at $6 million in 10 years.



IMPORT SUBSTITUTION

Jamaica cannot afford to go on using up scarce foreign exchange for the continued importation of foodstuff that can be produced here.

The table below gives an indication of import trends on certain staple items which must be brought under control.

	(J$ Millions of Imports)			
Commodity	1970	1974	1978	1982
Rice	$6.9 m	$22.3 m	$25.9 m	$29.9m
Dairy Products *	$7.5 m	$23.2 m	$23.8 m	$48.9m
Soya Bean			$19.6 m	$25.8m
Corn	$4.2 m	$14.6 m	$30.6 m	$36.7m

* Milk, Cream, Butter, Cheese and Curd.

These figures show the extent of the drain in our foreign exchange over the years and highlight the opportunities for local production.

	1970	1974	1978	1982
Total Food Import Value	$69.1	$175.2	$234.5	$390.8

Agro 21 is not only gearing Jamaica to substitute these imports but has already confirmed 4,600 acres of rice-land for investment with over 1,000 in production in St. Elizabeth and 1,500 at Meylersfield and surrounding areas in Westmoreland, and mills have already been ordered. Substantial increases are targeted for production of substitutable edible oil products from the coconut.

Cassava is to be developed as a supplementary source of carbohydrate and new high-yielding varieties are being introduced. The afforestation programme is aimed at increasing the local output of wood and other forest products for the furniture, chipboard and construction industries. Now, the livestock industry is under intensive survey and programming to expand production in beef, dairy and small stock farming.

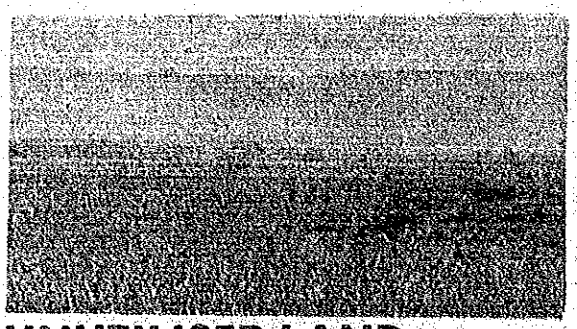
INTEGRATING SMALL FARMERS WITH AGRO 21

Agro 21, through the Ministry of Agriculture, on the basis of a survey now being completed, will allocate to our small farmers selected blocks of land for the production of specific crops. In these instances there will be an organised programme for assisting with inputs, such as chemicals, fertiliser, technology, financing and marketing. Farmers operating on their own land will have the opportunity, along with the other farmers of entering into contractual arrangements with the "Mother Farms" for the production and marketing of their produce. The Ministry of Agriculture Extension Service will assist by involving themselves with the "Mother Farms", thus providing the vital link between Agro 21 operations and the small farmers. For those small farmers already involved in the production of ethnic food crops such as yams, cocoa, dasheen, plantain, etc., Agro 21 will work with the Ministry of Agriculture and the other government marketing agencies to ensure the continued development of their export market.

Already under construction are facilities to certify ethnic exports to the North American market and a major breakthrough has taken place at the Coleyville Project in Manchester for the preserving of yams. This allows for this product to stay fresh for up to 6 months so as to ensure continued marketable quality on a year-round basis in our export markets.

In addition, the government has concluded an agreement with the U.S. AID for the construction of 25 assembly and grading stations to handle the produce of our small farmers.

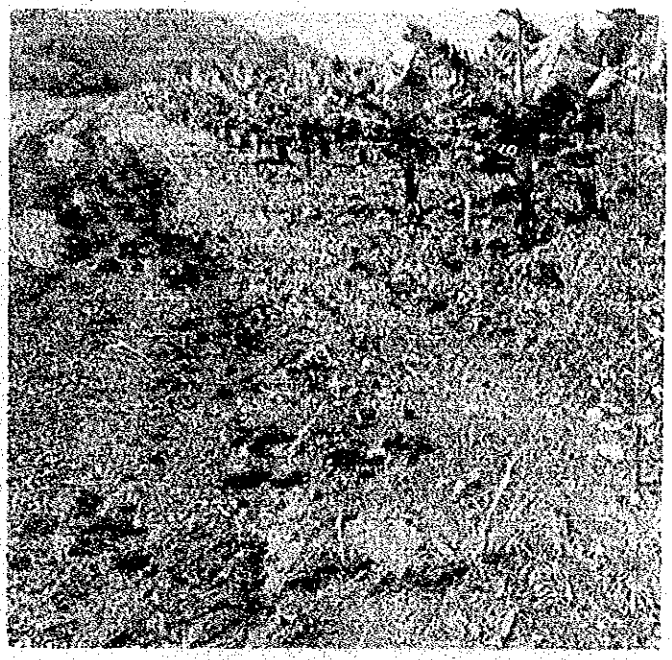
MAKING USE OF OUR UN



UNUTILISED LAND

Throughout Jamaica there are large acreages of land, suitable for agriculture, but, lying idle. These blocks of land are being identified and classified in relation to the zoning defined by the physical geographic plan. In the case of publicly-owned land, its allocation for use will be determined by an assessment of its highest use in terms of cost-effective production capabilities. These lands would then either be put at the disposal of small farmers, under an organised production plan, or would be made available, through a lease or through a joint venture arrangement, to private investors.

In the case of private land holdings, where the owner has decided on a feasible project, credit and financial arrangements can be arranged through the Agricultural Credit Bank or the National Development Bank. Where the owner has not yet decided what to do, Agro 21 will help package a programme to help him bring his acreage into full production.



NDER-UTILISED ASSETS

UNDERUTILISED LAND

There are large acreages of land in Jamaica that are not now being used to their full production capabilities. Where these lands are in private hands, Agro 21 will invite the owners to discuss development strategies in order that these lands can be brought into full production. Where the land is publicly-owned, government has already established a strategy for development.

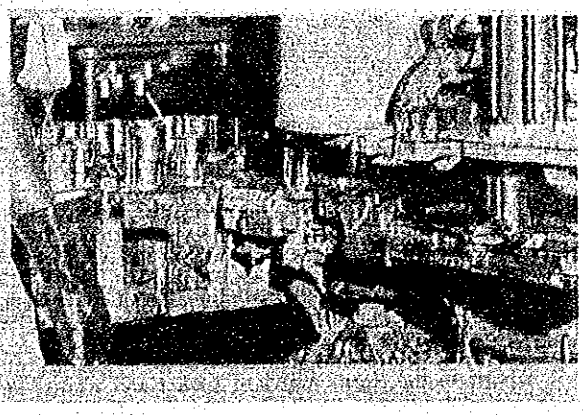
PEOPLE OUR MOST IMPORTANT ASSET

With over 25% unemployment, our people represent one of the largest underutilised resources that Jamaica has available for development. By bringing together land and financing, Agro 21 will create opportunities for employment and useful occupation, particularly in rural Jamaica, as agriculture provides the quickest means of employment for the greatest number of people.

FACTORIES

There are some 40 factories engaged in Agro-industrial production and only 40% of their capacity is being utilised due mainly to a shortage of raw materials for processing. Under Agro 21 these factories will have a continuous reliable supply of the ingredients and products necessary to maintain production at an increased capacity. This will result from the organised production under Agro 21 which takes into account the supply needs of these factories after the draw-off of A1 products for our targeted export markets.

There is a similar underutilisation of machinery and equipment in the main areas of agriculture. These will be upgraded and brought into full production to maximise agricultural production in these areas to generate more foreign exchange and stimulate employment.



AGRO INDUSTRY

It is proposed to develop stronger linkages between the Agricultural and Industrial Sectors through a deliberate process of exploring the opportunities for converting agricultural raw materials into processed commodities and industrial goods. Similarly, it is expected that the industrial sector will explore further opportunities to manufacture more and more of the inputs required by the Agricultural sector. In the first case, studies are currently being undertaken into the feasibility of converting certain raw materials into fuel alcohol. Further, the conversion of what was regarded as useless coconut trunks into boards, and floor tiles for the construction, and furniture industries, demonstrates that there are several opportunities from the agricultural sector which are already being capitalized on. The conversion of coconut, cocoa, coffee, etc. into their final products, and fruits to juices, jams and jellies, are other examples.

The opportunities for agro industry are many and varied. They will require the establishment of processing plants and the expansion of packaging facilities. For example, Aloe Vera will require a new processing plant for leaf extraction and for the packaging of the extract. As the programme expands, there will be need, among other things, for additional rice milling capacity; facilities for the processing and packaging of shrimp and fish and additional facilities for processing coffee, as well as the by-products of the cattle industry.

Thus, firms will have a variety of opportunities created through Agro 21 to establish new processing facilities and to use the existing facilities more fully.

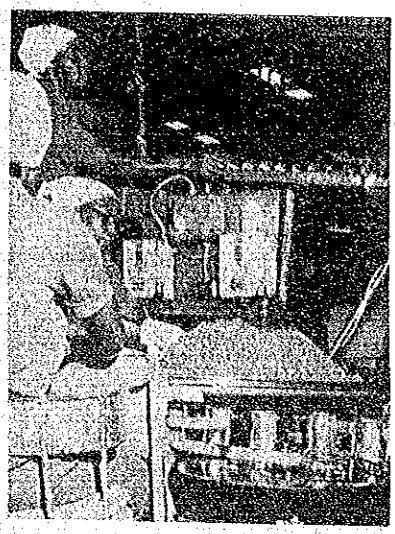
There are four specific areas for agro-processing and agro-industrial development which are candidates for immediate attention:

(a) The citrus industry which will be able to provide raw materials to process and manufacture a variety of juices, jellies, and jams and provide pulp as an ingredient in the manufacture of animal feed for the beef and dairy sectors;

(b) The banana industry which will be able to supply fruits (not required for export and local markets) for the manufacture of chips and baby foods for the domestic and export markets as well as ingredients for animal feeds and industrial starches,

(c) Pineapple – this unique product allows for 100% utilization of the fruit and vegetative growth in the form of juices, solid pack items, bakery fillers and animal feeds.

(d) The beef industry, the expansion of which will give rise to increased supplies of skins for the leather and footwear industries. Other spin-offs from beef production include bone meal for the cattle-feed industry; animal waste for use as organic fertilizer, and animal hair to produce brushes.



The programme is expected to impact significantly on other areas of industrial production. It will be most evident in the paper products as well as the container industry through increased demand for bottles, boxes and other plastic and metal containers , and in the printing industry for the production of labels.

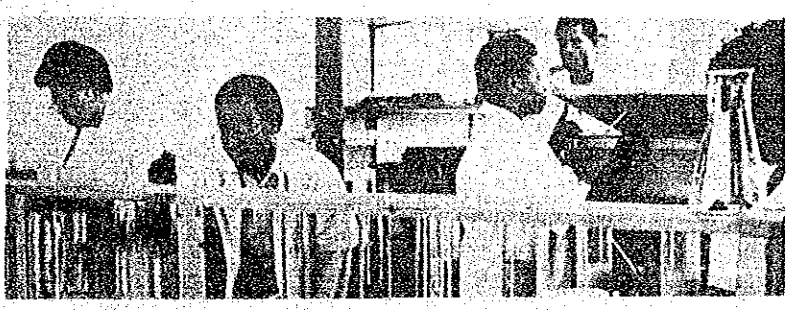
NEW TECHNOLOGY

Agro 21 will transmit to the farming community by example, as well as by other means, such agricultural technology at its disposal, as will assist in raising the overall level of productivity and incomes in the agricultural sector.

In pursuit of this objective, active steps are being taken to educate farmers on new technology related to their particular crops and to demonstrate by practical means the technical and economic feasibility of recommended innovations in agricultural practices. It is anticipated that the demonstration effect will influence an increasing number of farmers to shift from the traditional approach to farming into business-like modern commercialised agricultural practice.

Specific strategies relating to technology have been devised to ensure effective achievement of the objectives set for AGRO 21 including:

i) The application of appropriate modern technology such as:
   a) the semi-mechanised production of root crops;
   b) introduction of improved varietal species (already in place at the Thetford Seed Farm);
   c) the introduction of improved irrigation practices including drip irrigation;
   d) adoption of tissue culture transplant techniques;
   e) application of ova transplant and improved artificial insemination techniques;



ii) Locating processing plants at or near crop production sites;

iii) Expansion and development of plant nursery facilities;

iv) Improvement in the delivery of extension services;

v) Maximum development of the opportunities for establishing forward and backward linkage industries;

vi) Modernization and upgrading of container and packaging facilities and materials including plastics, glass, metal, wood and paper;

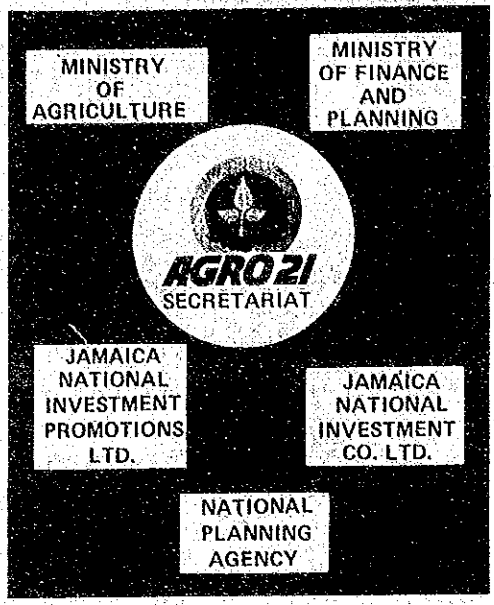
vii) Introduction of New State of the Art food processing techniques to keep pace with market demands.

viii) Dissemination of modern production techniques through the use of properly designed "Tech Packs".

The difference between this approach to agriculture as against what was practiced in the past, is that the transfer of Agro 21 technology is linked to commercial practices, involves on the spot demonstrative activities and it includes investor commitment.

Proof of this is in the years of accumulation of agricultural technology which are still on the shelves, unused in various government agencies.

Co-ordinating AGRO 21



Based on its Agro-industrial potential, Agro-21 is expected to have a major impact on several institutions in the Public Sector. The programme is expected to serve as a mechanism for the mobilisation of the manpower and other organisational resources and activities of many public as well as private institutions in the interest of economic recovery. In order to facilitate the coordination required, Agro-21 is being developed under the direction of an Agro-21 Steering Committee chaired by the Prime Minister and Minister of Finance and Planning, with the Minister of Agriculture as Deputy Chairman.

The institutional framework within which Agro-21 will operate is designed to increase the interface relationships among those agencies of government whose activities are critical to the planning, implementation and monitoring of the programme. This approach is being initiated through the Steering Committee and it is expected that the maximum amount of co-ordination and timely decision-making in planning and implementing the various components of Agro-21 will flow from it.

The Steering Committee

This Committee (already in existence) will perform the role of directorate to the Agro-21 Secretariat. The core representation on the Steering Committee is drawn from the following Ministries and Agencies:

Agro 21 Secretariat - Office of the Prime Minister
Ministry of Agriculture
National Planning Agency (NPA)
Jamaica National Investment Company (JNIC)
Jamaica National Promotions Ltd. (JNIP)
Agricultural Credit Bank
Department of Statistics
Scientific Research Council
US-AID

The main functions of the Committee are:

i) to coordinate the acitivites of the agencies involved in the planning and implementation of Agro-21.

ii) to issue such policy directives as are necessary to ensure that the infrastructural requirements to facilitate the implementation of Agro-21 are put in place.

iii) to formulate policy and give general guidance to the operations of the Agro-21 Secretariat.

iv) to evaluate and approve all projects falling under the aegis of the programme.

v) to take such steps as are necessary to ensure that the programme targets are achieved.

Apart from the Chairman, the main office bearers on the Steering Committee are the Minister of Agriculture (Vice Chairman), a Parliamentary Secretary in the Ministry of Agriculture, who serves as Co-ordinator of the Programme, a full time Project Director, and a technical team of 5 experts provided under the auspices of U.S./AID.

The Core Public Sector Organisations and other institutions that are involved in the planning and implementation of the programme are represented on the Agro 21 Secretariat.

The Agro 21 Secretariat

The Secretariat has the following main functions:

i. establishing information sourcing networks and data accumulation systems for the creation of an industry data bank to provide, among other things, information on crops; F.O.B. *sale prices; transportation* costs, wholesale and retail pricing, market demand, and volume/price sensitivities on an ongoing basis.

ii. collaborating with Jamaica National Investment Promotions Limited (JNIP) to expand the list of investors for agri-business investment in Jamaica and undertaking joint investigations with the JNIC and JNIP into specific investment opportunities for potential investors.

iii. checking lands currently under cultivation or planned for cultivation in order to assess and advise on the relevant development strategies to be employed.

iv. advising on strategies to expand acreage, improve yields, and maximise returns on investment in agriculture.

v. assessing agriculture joint-venture investment proposals and opportunities in collaboration with the Jamaica National Investment Company.

vi. initiating seed projects for new crops and supporting the expansion of traditional crops.

vii. determining the infrastructural requirements for crop establishment in new locations.

viii. collaborating with the Jamaica National Export Corporation to develop new market links for export crops.

ix. advising on the establishment or improvement of procedures for the orderly development of systems to link the operations of the producer with the secondary and tertiary stages of processing, shipping and marketing.

x. facilitating the establishment of secondary industries, i.e. processing, packaging for local and export markets, etc.

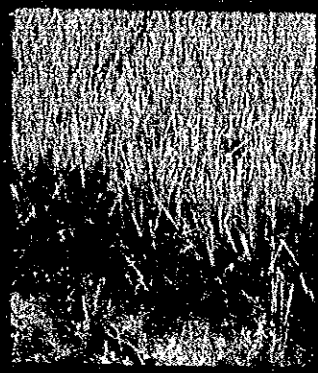
xi. providing technical assistance, in addition to developmental project management, in agriculture and processing.

AGRO 21

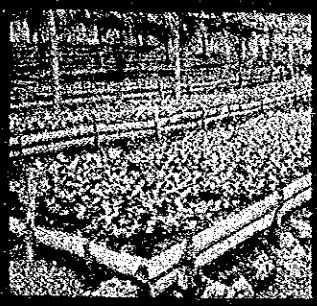
Projects now in Operation

These are the first 9 projects that are now in operation under Agro 21. They include crops that allow for the immediate use of unutilised and underutilised land to facilitate full scale agricultural production, quick job-creation and foreign exchange earning opportunities. These projects are located in most parishes in Jamaica, at varying stages of devleopment. It is the start of Agro 21 – projects with products on their way, setting the stage for full-scale agricultural production in Jamaica.

A foliage cultivation project near Albion in St. Thomas.



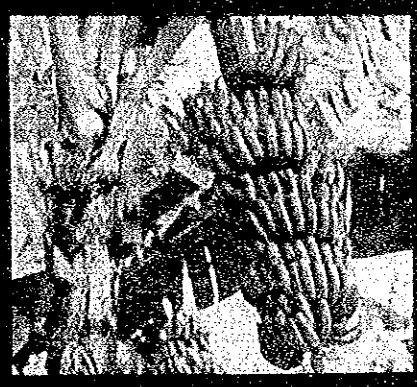
Rice cultivation at BRUMDEC, St. Elizabeth.



Coffee nursery – seedlings ready for planting.

Winter Vegetables, now being produced at Spring Plains in Clarendon.

One of the 5 Aloe Vera nurseries that have been established in Trelawny



First bunch of the Gran Nain variety grown from tissue culture at Duckenfield, St. Thomas.

Freshly reaped Silver Perch from Agro 21 Aquaculture project in St. Catherine

A new breakthrough in the curing of yams has taken place at Coleyville in Manchester – to increase our export market.

Beekeeping and Honey production, now involving young people islandwide.

AGRO 21. its Goals

IMMEDIATE

Immediately, Apro 21 is looking at the development of 185,000 acres of land of which 87,673 acres have already been committed to 81 projects covering 17 sub-sectors as follows:–

SUB-SECTORS	ACREAGE	IDENTIFIED PROJECTS
1. Winter Vegetables	1,515	4
2. Bananas *	3,350	2
3. Coffee	7,390	6 (1)
4. Ethnic Crops	7,000	13
5. Tobacco	1.000	1 (2)
6. Coconuts	21,000	1 (all island)
7. Rice	4,600	3
8. Afforestation	28,370	2
9. Citrus	5,500	2 (3) (4)
10. Honey	(1,065 Hives)	1 (all island)
11. Aloe Vera	1,000	5 (nurseries)
12. Ornamental Horticulture	208	25
13. Orchard Crops	40	1
14. Aquaculture	674	6
15. Dairy	(open)	2
16. Beef	2,526	3
17. Cocoa	3,500	4
	87,673	81

* Negotiations are to be concluded with investors for the resuscitation of 3,882 acres in St. Thomas, Portland, St. James and Clarendon.

Note:
(1) 6 major financial projects encompassing a large number of smaller projects
(2) This covers all Coconut Industry Board growers throughout the island.
(3) 2 major funded projects encompassing various citrus areas in 4 parishes.
(4) Several areas in various parishes.

Within these sub-sectors 9 projects are already in place. Twenty-two more projects are in the final stages of planning.

LONG TERM

Agro 21's long-term goal is to complete full agricultural production on 200,000 acres of land, comprising 27 identified sub-sectors of production over a period of 4 years.

In addition to the initial list of 17 product categories, the other 10 are – Pineapple, Cassava, Ethanol, Sunflower/ Sorghum, High-Yielding Cane, Cotton, Corn, Macademia Nuts, Jojoba, Winged beans.

The principal objectives of the programme are:

(i) The transformation and modernization of the agricultural sector beginning with the sub-sectors/projects targeted for Agro 21 and the creation of a major conduit through which private and institutional capital and technology can be mobilised for further development and growth of the Jamaican economy;

(ii) the achievement of strong annual growth in the gross foreign exchange contribution of the agricultural sector during the next four years in order to bolster current efforts aimed at achieving a positive net international reserves position within the shortest possible time frame;

(iii) the achievement of strong annual growth in direct employment in agriculture during the four-year period, 1983/84 to 1986/87;

(iv) the utilization of opportunities for the generation of income, creation of jobs and the rebuilding and development of infrastructure in rural Jamaica in order to effect significant improvements in the quality of life in the countryside wherever idle lands exist. Agro 21 will therefore support and reinforce the programme for comprehensive rural development.